

















































































































































































































































































































































































































































































































































































































## CHAPTER XCV.

### INFLAMMATORY DISORDERS.

#### *Serous inflammations.*

652. Acute inflammatory exudations having a serous character take place into the substance of the brain and cord, into the membranous envelopes, and into the ventricles; and they give rise to grave and even fatal disturbance of the nervous functions.

**Acute serous leptomeningitis** is an affection in which a sudden congestive hyperæmia is followed by serous effusion into the subarachnoid and pia mater, and into the cerebral ventricles. The quantity of liquid found in the membranes at the time of death varies somewhat in different cases, but it is seldom great. The amount of blood in the congested vessels is also by no means constant. The ventricles are more or less dilated by the effusion (inflammatory internal hydrocephalus); sometimes so greatly that the convolutions are visibly depressed and flattened by pressure against the skull, while the cerebrospinal liquid is to some extent forced out of the subarachnoid spaces. The choroid plexuses are usually hyperæmic: the liquid in the ventricles and subarachnoid spaces is clear or slightly opalescent, and often contains minute flakes of fibrin. It is richer in albumen than the normal cerebrospinal liquid (HUGUENIN) and has floating in it a few pus-corpuscles. A few extravasated leucocytes may be seen in the neighborhood of some of the cortical vessels.

The disorder is commonest in infancy or early childhood, rare in adult life: it not infrequently accompanies the early stages of infective diseases such as measles or scarlatina. Very probably the oedema of the brain and meninges which sometimes supervenes in nephritis is in part at least of inflammatory origin. Perhaps too some of the cases in children are induced by the virus of epidemic cerebrospinal meningitis (Art. 653): frequently however no cause can be certainly assigned, though scrofula, rickets, and syphilis are believed to be predisposing conditions.

If the inflammatory oedema is not fatal it often disappears speedily, though sometimes it issues in a chronic inflammatory condition manifested by thickening of the meninges and permanent and increasing dilatation of the ventricles: this condition is called **chronic hydrocephalus**, and it sometimes comes on gradually and insidiously, that is to say without any markedly acute onset.

Of more common occurrence than these genuine diffuse serous exudations is the **localized inflammatory œdema** of the brain, cord, or membranes which is set up around foci of purulent, granulating, septic, tuberculous, syphilitic, or traumatic inflammation, or around new growths.

When the nervous tissue is the chief seat of œdema it looks moist and glistening, and is softer than in health. There is usually some accompanying circumvascular extravasation of leucocytes, partly in the adventitial sheaths of the vessels, partly in the surrounding tissue.

### *Purulent inflammations.*

**653. Purulent leptomeningitis.** Purulent inflammation of the soft membranes (pia mater and subarachnoid tissue) is preceded first by the hyperæmia which is the first stage of all acute inflammations, then by serous exudation, and lastly by an extremely abundant accumulation of leucocytes in the circumvascular spaces. The veins, engorged and dilated, show streaks and patches of yellow along their course, and these rapidly extend, owing to the continued extravasation and infiltration. The opacity thus occasioned sometimes becomes so dense that the gyri of the brain and the surface of the cord are entirely concealed by it.

In simply purulent meningitis the exudation is composed of pus-corpuscles and extravasated liquid. In the sero-purulent and fibrino-purulent forms the exudation has a turbid muddy appearance, is more liquid, and contains granules, fibres, and (less frequently) hyaline clots of fibrin.

The exudation lies mainly in the clefts and spaces of the pia mater and subarachnoid tissue. The cells covering the trabeculæ of the connective tissue are for the most part cast off and degenerate. The veins and venules are thickly surrounded with leucocytes, and their walls penetrated by them. Sometimes the venous channel is crammed with leucocytes, especially towards its periphery; sometimes it is plugged with hyaline or granular coagula. When the arteries are surrounded by extravasated cells the adventitial coat is seen to be infiltrated with them, and the like is often true of the middle and inner coats.

The cortex of the brain and the cord are sometimes all but unaffected by the meningitis, being perhaps only slightly moister than usual, though it is frequently possible to demonstrate that changes have here and there taken place in the nerve-elements. In the cord we find swelling and partial disintegration of the axis-cylinders and degeneration in the medullary sheaths and nerve-roots. In the cortex the ganglion-cells become swollen and lose their finer processes.

Often enough the inflammatory change advances along the vessels to the cortex, the pial sheaths especially of the veins becoming filled with leucocytes. Or the change may extend to the nervous tissues in a

more generally diffused manner (Art. 654). The nerves issuing from the brain and cord are frequently infiltrated with cells.

When the inflammation extends through the transverse fissures of the base of the brain to the telæ choroideæ within the ventricles, a purulent or sero-purulent exudation is poured out, the liquid contents of the ventricles are augmented and rendered turbid, and the plexuses swell up and become covered over with pus or fibrino-purulent flakes. The ependyma and underlying brain-substance become moist and sometimes morbidly soft. When the distention of the ventricles is great the brain-substance is compressed, the gyri flattened, and the subarachnoid liquid forced out; the result being that the meningeal structures of the convexity become morbidly dry.

The seat and the extent of the inflammation vary greatly, depending of course on the exciting cause and on the manner in which it reaches the membranes. As to the nature and properties of the exciting causes we know little, but it is probable that micro-organisms are frequently at work, and probably also specifically distinct micro-organisms in different forms of the disease. In many cases micrococci have been found in the inflamed tissues, but it is not likely that they are always of the same kind or the same virulence.

Irritant matters (organic or not) may reach the meninges in the first place by way of the blood-vessels, in which case we might call the meningitis **embolic**.

If it chiefly attacks the convex surface it is described according to its distribution as local or general, unilateral or bilateral, meningitis of the convexity. Affecting the base it is called basal or basilar meningitis, and in the case of the cord spinal meningitis. In basal meningitis the cerebral axis is usually covered with pus, and the subarachnoid cisterns are much distended with the exudation.

**Hæmatogenous purulent meningitis** occurs in connection with traumatic pyæmia, gangrenous and croupous pneumonia, ulcerative tuberculous phthisis, endocarditis, gangrenous bed-sores, acute rheumatism, purulent pleurisy (empyema), scarlatina, typhoid, inflammation of the umbilicus in infants, etc. It is moreover the essential symptom of the infective disease known as **epidemic cerebrospinal meningitis**. As its name indicates the exudation in this disease extends over cord and brain, though by no means uniformly. When the inflammation is at its height it is usually purulent or fibrino-purulent, seldom hæmorrhagic, though cases rarely occur in which some small hæmorrhages do not appear. If death ensues within the first few days the quantity of exudation poured out is very small: sometimes nothing but a circum-vascular infiltration of cells can be made out. In more advanced stages the subarachnoid liquid has a turbid whey-like appearance.

Both brain and cord are always involved, the cellular infiltration spreading from the pia mater along the vessels or directly to the cortex

of the brain and the substance of the cord. In addition to this small patches of inflammation (sometimes hæmorrhagic) are invariably found in the interior of the cerebrum: STRÜMPPELL says they are usually very numerous. The smallest form mere clusters of cells in the pial sheaths of the vessels, the larger ones are quite extensive cellular infiltrations, and are accompanied by softening of the infiltrated region. If the patient survives these patches may become abscesses. Epidemic cerebrospinal meningitis is thus accompanied by encephalitis and myelitis, and even after cessation of and recovery from the meningeal affection **cerebral abscess** may be left as a sequela.

A second group of purulent inflammations are due to **extension** from contiguous parts, either by continuity or by way of the blood-vessels or lymphatics. Thus osteitis of a vertebra or of the petrous bone extends directly to the meninges: suppuration of the nose, frontal sinuses, base of the skull, scalp (ulcers, erysipelas, eczema), internal ear, and eye (panophthalmitis) lead to suppuration of the membranes, the various vessels which pass from the bone inwards to the membranes serving as channels of infection. Especially dangerous is puriform softening of thrombi within the veins of the skull or the sinuses of the dura mater. Lastly, purulent inflammation of the brain itself may lead to the like in the meninges. According to some (FISCHER, BILLROTH, HUGUENIN) simple concussion of the brain without any wound of the soft parts or bones occasionally gives rise to purulent meningitis; HUGUENIN and others say the same may occur after sun-stroke.

The inflammation in all these cases will naturally begin where the irritant or exciting cause first acts, that is to say, it begins as a local affection. The wide communication between the several subarachnoid spaces contributes however to the speedy extension and generalization of the process.

Purulent meningitis, especially when it is cerebral, is usually fatal, though in some cases of the epidemic cerebrospinal disease recovery takes place. In the latter event the exudation is in the course of time re-absorbed, but usually certain whitish thickenings of the membranes due to fibrous hyperplasia, and some permanent dilatation of the ventricles, remain as evidence of the attack. Under certain conditions not fully understood the acute inflammation passes into a chronic one, the membranes undergoing cellular infiltration and becoming remarkably thickened. When the inflammation has been mainly confined to the pia mater, it may result in atrophy of the underlying nervous tissues (Art. 656).

STRÜMPPELL and WEIGERT have suggested that in cerebrospinal meningitis the infective virus may perhaps pass from the nose into the interior of the skull. The author is unable to accept the suggestion. Though he is convinced that purulent meningitis does not start from the nose, the phenomena of the epidemic affection appear to exclude that channel of infection. The manner in which the inflam-

matory change is distributed over the various parts of the meninges, the occurrence of numerous foci within the brain and cord, the frequent accompaniment of arthritis in various joints, etc., all indicate that the poison is spread by the channel of the blood-vessels, and thus reaches the central nervous system. The inflammation of the superior nasal meatus is a mere concomitant of the meningitis.

References on cerebrospinal meningitis:--ZIEMSEN, *Ziemssen's Cylopædia* II.; WUNDERLICH, *Arch. d. Heilk.* V., VII.; ZENKER, *D. Arch. f. klin. Med.* I.; STRÜMPPELL, *ibid.* XXX.; LANCEREAUX, *Traité d'anat. pathol.* II.; RADCLIFFE, *Reynolds' Syst. of med.* II. 1868; BURDON-SANDERSON, *Rep. of Med. Off. of Privy Council* 1866.

**654. Purulent encephalitis and myelitis.** In purulent meningitis the underlying nerve-tissue undergoes more or less extensive inflammatory change, and we might therefore very well describe the process as a meningoencephalitis or meningomyelitis. Under certain conditions however the inflammation of the brain or cord becomes the more marked feature, and this affects even the naked-eye appearance of the affected parts. This is especially the case in traumatic inflammations, set up by cuts, blows, stabs, or gun-shot wounds. The tearing and bruising of the tissue by the mechanical violence gives rise to disintegration or necrosis of the nerve elements, while the weapon which causes the injury may penetrate the substance of the brain or cord, or drive before it splinters of bone, or lacerate the blood-vessels and lead to hæmorrhage into the meninges or into the nerve-substance. If the wound becomes septic decomposition of the extravasated blood and of the damaged tissue takes place, and this induces violent purulent or putrid meningitis, encephalitis, or myelitis. The decomposing matters assume a dirty-brown, gray, or greenish color and give off a putrid odor. The actual inflammation begins with swelling of the nerve-substance and the formation of numerous points of hæmorrhage. The change first appears in the part near the injury, but often spreads widely, the hæmorrhagic extravasation extending deeply into the tissue, and also over a considerable area of the cortex beneath the inflamed pia mater. When the vessels are lacerated *ab initio* the swollen nerve-substance is tinged more or less deeply with yellow from the diffusion of the coloring-matter of the extravasated blood.

The hæmorrhagic foci lie always in the immediate neighborhood of small vessels, but as they grow larger they spread beyond the region of the adventitial lymph-sheaths into the nerve-tissue, and when the change is no longer quite recent they appear infiltrated with leucocytes which have left the vessels. This migration of leucocytes is the first stage of the suppurative process, and it steadily increases, until at length the nerve-tissue is as it were inundated by the multitude of extravasated cells, and presently undergoes degeneration and dissolution. When a portion of the tissue is thus liquefied and converted into a yellowish or

grayish or putrid pus-like cream, the encephalitis or myelitis has issued in **abscess**.

In like manner purulent meningeal inflammations due to other causes (*e. g.* suppuration of bone, or septic embolism) sometimes extend to the substance of the brain or cord and lead to abscess. As a rule however the process is not so violent or so rapid.

When irritant matters reach the interior of the brain or cord through the blood-vessels without affecting the meninges on the way, a local inflammation is set up which at first may not extend to the pia mater. If the irritant is one which has the power of setting up suppuration (such as the pyæmic micrococci), and lodges in a capillary or small vein, its first effect is to produce minute hæmorrhagic extravasations. These in the course of a few days become yellowish-white, with perhaps some slight blood-staining in the larger patches, and rapidly assume the appearance of abscesses. The number of extravasated white cells increases steadily, and at length the nerve-tissue breaks down and liquefies.

If at the same time one or more of the arteries have been blocked by embolism the inflammatory changes are accompanied or preceded by those characteristic of anæmic or hæmorrhagic necrosis (Art. 642). The final result is however the same: an abscess is formed, distinguished only from those already described by its possibly larger size.

Both forms of embolic suppuration occur under the same conditions as lead to purulent meningitis, namely pyæmia, endocarditis, suppuration or gangrene of the lung, putrid bronchitis, croupous pneumonia, cerebrospinal meningitis, etc.

Embolic abscesses arise most commonly in the cerebral hemispheres and cerebellum, rarely in the cerebral axis, and more rarely still in the cord: they are sometimes multiple. They contain as a rule creamy-yellow or pale-greenish pus. The smallest are as large as a pin's head, the larger ones may occupy the greater part of a lobe: most frequently they are from the size of a walnut to that of a hen's egg.

When recent the wall of an abscess has a broken-down appearance, the tissue around being oedematous and often beset with small points of hæmorrhage. If close beneath the pia mater an abscess generally sets up meningitis, and if it breaks into a ventricle a violent inflammation of that region ensues.

Only the very smallest abscesses are capable of absorption and repair by cicatrization. The larger ones, if not fatal by pressure or meningitis, become enclosed in a granulating capsule or membrane and may exist for years in a quiescent state. So early as four weeks after its first appearance an abscess may be walled off from the surrounding tissue by a gray or grayish-red zone: in the course of months the zone grows broader and firmer, measuring from 2 to 5 mm. across. This is simply granulation tissue, which by and by is transformed into cicatricial fibrous tissue. In old abscesses the enclosing membrane is thus

made up of an inner granulating layer of cells and vessels and an outer fibrous layer.

Once encapsuled or 'encysted' in this way, the abscess slowly grows by the accumulation of pus derived from the granulating membrane; this secretion is probably not continuous, and in long-standing abscesses must be very slight. The surrounding brain-tissue is compressed, and sometimes atrophies or even degenerates and breaks down. At any moment moreover inflammatory oedema and fresh cellular infiltration may be set up in the compressed tissue, and these give rise to disturbance of the cerebral functions and often enough lead to a fatal issue. Nor is the danger of perforation into a ventricle or extension to the pia mater by any means removed when the abscess is encapsuled. Cerebellar abscesses may by pressure on the veins of Galen set up dropsy of the ventricles. Recovery from a large abscess is indeed possible only after surgical evacuation of its contents.

References on cerebral abscess:—LEBERT, *Virch. Arch.* vol. 10; SCHOTT, *Würzburg. med. Zeitschr.* II. (1862); BILLROTH, *Arch. d. Heilk.* 1862; HUGUENIN, *Ziemssen's Cyclopædia* XII.; R. MEYER, *Zur Path. d. Hirnabscesse* In. Diss. Zürich, 1867; MAAS, *Berl. klin. Woch.* 1869; WYSS, *Jahrb. d. Kinderheilk.* IV. (1871); CRUVEILHIER, *Anat. pathologique* part 33; NAUWERCK, *D. Arch. f. klin. med.* XXIX.; RETTELHEIM, *ibid.* XXXV. 1885 (abscess after empyema); EISELSBERG, *ibid.* (abscess after sunstroke); TOYNBEE, *Diseases of the ear* London 1868; GULL, *Guy's Hosp. Reports* III. (1857), *Reynolds' Syst. of med.* II. London 1868; HAYEM, *Arch. de physiol.* 1868.

### *Chronic Meningitis.*

**655. Secondary forms of chronic leptomeningitis.** Chronic inflammation of the cranial or vertebral bones, or of the dura mater, are apt sooner or later to extend to the arachnoid, the subarachnoid tissue, and the pia mater. This extension occurs most commonly in tuberculous and syphilitic disease, though it is also met with in other inflammations, such as for instance are set up by mechanical injury to the bones. The idiopathic inflammation known as internal pachymeningitis, which is characterized by the formation of false-membranes and adhesions on the inner surface of the dura mater, sometimes extends to the inner meninges also.

The arachnoid having no vessels of its own is only passively affected by the inflammatory process, and undergoes more or less extensive degenerative changes. In the pia mater on the other hand, and in the vascular portions of the subarachnoid meshwork, inflammatory disturbances of the circulation make their appearance, and lead in the first place to infiltration of the latter tissue and of the arachnoid.

The next stage varies with the character of the inflammation. If it be of tuberculous or syphilitic origin, in course of time the arachnoid, the subarachnoid tissue, and the pia mater become milky and thickened,

partly from cellular infiltration, partly from the new-formation of fibrous tissue. Adhesions are not infrequently formed between the dura mater and the arachnoid. These are usually most dense and abundant in traumatic pachymeningitis; in the idiopathic form they are soft, fibrinous, and vascular.

But secondary chronic inflammations of the inner meninges are still more frequently the result of acute or chronic disease of the brain and cord. Every subpial inflammatory and degenerative process affecting the nerve-substance is capable of inducing meningeal inflammation: and tumors of the brain or cord act in like manner either directly, or through destructive changes in their own substance or in the tissue about them.

The pia mater and the surface of the central nervous organs stand in the closest possible connection, and in all degenerative processes affecting the latter, whether they are inflammatory or not, some of the products of disintegration are apt to reach the pial tissue and the sub-arachnoid spaces, and there give rise to turbidity or (in the case of hæmorrhage) yellow or brown pigmentation. The turbidity is more marked when the disintegrated matters possess irritating properties and excite inflammation. Then abundant extravasation of leucocytes ensues, and in time a more or less extensive fibrous hyperplasia is the result. In many cases the hyperplasia is well marked (Art. 642, Fig. 260), the meninges becoming dense, thick, white, and opaque. Both the sub-arachnoid and the arachnoid tissue take part with the pia mater in this hyperplasia, the trabeculæ of the former becoming thicker and coarser, new trabeculæ being formed, and the characteristic structure of the tissues obscured or altered. Calcareous concretions are common in the thickened membranes; and peculiar-looking cells are aggregated into spherical clusters, then become homogeneous, and lastly calcified, and are surrounded by tiny capsules of cells and new-formed fibrous tissue.

Secondary meningitis of the spinal cord is similar to that of the brain, and follows upon inflammations of the vertebræ or spinal dura mater. In some cases the inflammation also extends to the substance of the cord itself.

**656. Hæmatogenous chronic leptomeningitis.** We have already pointed out (Arts. 652, 653) that acute meningitis of hæmatogenous origin, if not fatal, may issue in recovery by re-absorption of the exudation; but this is frequently accompanied by some thickening of the membranes due to new-formation of fibrous tissue. In certain not fully understood conditions the acute disorder passes into a chronic form, characterized by persistent cellular infiltration, and consequent thickening and opacity of the meninges; chronic internal hydrocephalus is a further sequela.

But there are other forms of chronic leptomeningitis which as to their causation, rise, and progress, differ notably from the foregoing.

We refer to those chronic (more rarely acute or subacute) inflammatory processes which are the most frequent though not invariable antecedent of certain mental disorders, especially that known as paralytic dementia or **progressive paralysis of the insane**. The processes in question and the mental disease as commonly defined are not exactly co-extensive: on the one hand they may be absent in cases where the mental disease exists, and on the other they are met with in cases where the symptoms if any have been other than mental.

The morbid conditions referred to have certainly not the same ætiological or clinical significance in all cases: they may be divided into two groups according to their anatomical characters, in other words according to their situation and the nature of the textural changes they induce.

In the first place we have changes affecting mainly the arachnoid and subarachnoid tissues and giving them a white opaque appearance, the opacity being limited to spots and streaks or more uniformly diffused: it is most apparent over the sulci and the subarachnoid cisterns, and occurs both at the base and on the convexity of the brain. It is still doubtful whether these opacities are always of inflammatory origin. They are histologically due to fibrous thickening, endothelial hyperplasia, or more rarely to cellular infiltration. If we are to reckon them provisionally as due to chronic inflammation, this would probably be best described as **chronic arachnitis** or **external leptomeningitis**. As to their causation they are observed in connection with chronic venous engorgement and with certain morbid states of the blood, as in alcoholism and chronic nephritis.

Of greater importance than the changes just mentioned, which after all can hardly be supposed to induce grave disorder of the nervous functions, are certain chronic affections which involve chiefly the pia mater and underlying nerve-tissue: in their later stages at least they are unmistakably inflammatory, and are therefore appropriately included under the terms **chronic meningoencephalitis** and **meningomyelitis**.

When the morbid process is well advanced the soft membranes, especially the pia mater, are visibly milky and opaque, the change showing best in the sulci along the blood-vessels, and sometimes also on the ridges of the convolutions. It is most common in the anterior parts of the brain, namely the frontal and parietal lobes, the other parts being little or not at all affected. Cases however are described in which the change is most marked in the temporal lobes.

The most striking of the textural changes is undoubtedly the cellular infiltration which pervades the pia mater (Fig. 273 *h*), and to a less degree the subarachnoid tissue (*b*). This is occasionally accompanied by a more or less extensive fibrous hyperplasia of these structures. In later stages accumulations of leucocytes (*i*<sub>1</sub>), and in smaller quantity red blood-cells and brown or yellow pigment (*i*<sub>2</sub>), appear in the adventi-

tial sheaths of the cortical vessels, and sometimes even of those supplying the white matter. But no great accumulations of cells are as a rule met with in the mass of the brain-substance itself. The cellular infiltration is not uniform, varying much even within the tissue of the pia mater. In the cortex comparatively few vessels are surrounded by masses of cells, and in the white matter perhaps one or two at most. Some of the vessels however show hyaline or fibrous thickening of the adventitial coat.

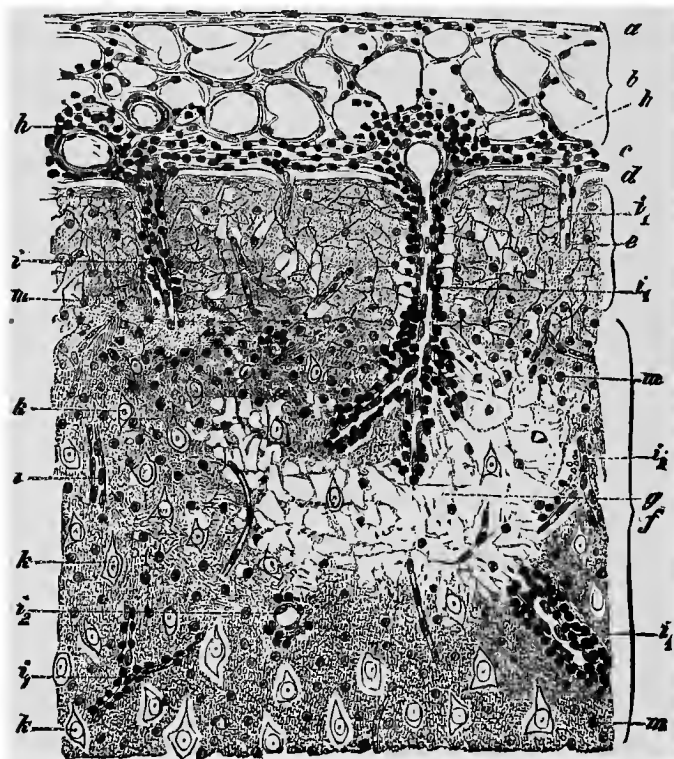


FIG. 273. CHRONIC MENINGOENCEPHALITIS WITH ATROPHY OF THE CORTIX.

(Section hardened with Müller's fluid and alcohol, stained with alum-carmine and ammonia carminate, and mounted in Canada Balsam:  $\times 150$ .)

- |   |   |
|---|---|
| a, arachnoid  | g, many of these have disappeared, a delicate reticulum remaining |
| b, subarachnoid tissue  | h, cellular infiltration of pia mater                             |
| c, pia mater  | i, unaltered blood-vessel   |
| d, superficial layer of cortex  | i <sub>1</sub> , pial sheath of vessel filled with leucocytes     |
| e, layer of small pyramidal cells; the cells have disappeared, and numerous stellate figures composed of glistening fibres have taken their place | i <sub>2</sub> , pial sheath filled with blood-cells and pigment  |
| f, layer of large pyramidal cells,  | k, ganglion-cell (of the third layer)                             |
|   | m, neuroglia-cells  |

The nerve-substance of the cortex is probably never entirely normal

in these cases; though it is not always easy to demonstrate the changes that exist. In very chronic cases it is often visibly atrophied, its depth being diminished to a half or a third of the normal: but the atrophy is far from being always uniform over the affected area, being sometimes most marked in particular convolutions or parts thereof. The atrophied areas are usually pale, seldom reddened, and are occasionally somewhat indurated.

As the white matter is at the same time diminished the affected portion of the brain is on the whole perceptibly smaller, and the space left vacant by the shrinking is filled up by liquid collecting in the sub-arachnoid tissue. Sometimes too the ventricles are dilated and their ependyma beset with granulations (Art. 650). When the atrophy is extreme the brain is sometimes so remarkably shrunken that it weighs less than 1000 grammes. The affection is therefore aptly described as **atrophic meningoencephalitis**.

The outer layers of the gray matter are usually the most altered. In both pyramidal-cell layers (*ef*) the number of cells is diminished, and here and there are patches in which all of them have disappeared (*g*). In sections mounted in Canada balsam the loss of the nerve-elements causes the tissue (normally so densely granular) to look as if it were full of holes and gaps, nothing but a fine scarcely-visible reticulum remaining at certain points. The layer (*e*) of small ganglion-cells (pyramidal cells) shows this in the most marked way: the neuroglia may be hardly apparent (*f*), or it shows as a meshwork of glistening fibres (*e*) interlacing irregularly or disposed in stellate patterns. The points of intersection of the fibres are sometimes occupied by nuclei, and now and then it is possible to demonstrate that the fibres are simply processes of the neuroglia cells. When the cortex is not visibly thinned the atrophy is slight and hardly to be made out in Canada-balsam preparations. Per-osmic acid brings out the fact that some of the nerve-cells are breaking down, with or without the formation of fat-granules.

The medullary or white matter of the brain is often in these cases not only shrunken but also interspersed with foci of degeneration.

The cord and pia mater is in like manner subject to cellular infiltration: not infrequently there is also present some degeneration and sclerosis of the pyramidal and of the posterior columns (Arts. 647, 648).

In the disease known as **paralytic dementia** or progressive paralysis, which is characterized by loss of intellectual power, emotional derangement, and illusions, the atrophic form of hæmatogenous chronic meningoencephalitis is an extremely common lesion. It must however be mentioned that not only this form but other chronic inflammations from traumatic injury of the head may lead to progressive paralysis, and that in patients who have died of the latter disease all that is found in some cases is simple non-inflammatory degeneration of the cortex and meninges. It would thus appear that the disordered nutrition and degeneration of the ganglion-cells and nerve-fibres is the essential feature; the

inflammatory infiltration and the increase of the fibrous structures serve to indicate the nature of the process (Art. 657) but do not determine the clinical symptoms.

BAYLE describes progressive paralysis as a chronic arachnitis, CALMEIL as chronic periencephalitis, PERCHAPPE as softening of the brain, TUCZEK as chronic meningitis, MAGNAN as diffuse interstitial meningoencephalitis, MENDEL as diffuse interstitial cortical encephalitis, LUYs as diffuse interstitial sclerosis. Most writers regard the affection as an inflammation corresponding in general to what we have described as chronic meningoencephalitis. The interpretations given to the various morbid appearances differ widely. Thus MIERZEJEWSKY and VOISIN regard the fibrils and stellate cells, which are often so markedly visible in the atrophied cortex, as fibrinous. MENDEL, LUBIMUFF, SELVILI, and others attribute much importance to the stellate cells, and think that they multiply considerably. This can only occur in a very few cases and to a limited extent. As a rule they are not increased in number, but they are merely more visible in the absence of the nerve-elements. The statements sometimes made as to multiplication of the ganglion-cells cannot be regarded as proven.

It is frequently asserted that in progressive paralysis the pia mater is abnormally adherent to the brain-surface, tearing away the latter as it is stripped off—but the test is of little value. It often fails where there is the most marked change both in pia mater and cortex, and only shows that the brain-substance is abnormally soft: the effect is in part at least due to post-mortem changes. It is better not to try at all to strip off the pia mater, for it renders the brain almost useless for minute examination afterwards.

MIERZEJEWSKY and others have affirmed that in this affection filamentous processes and ramified connective-tissue cells are found attached to the vessels of the cortex when isolated: the description is accurate, but the phenomenon is not characteristic, as it is found in connection with other morbid conditions and even occasionally in healthy brains. SIMON, ARNDT, SCHÜLE, and GREIFF have found in paralytic and other brains patches of clear hyaline substance in the neighborhood of the vessels.

According to TUCZEK (*Neurol. Centralb.* 1883) in paralytic dementia the medullated nerve-fibres of the cortex are especially apt to be lost, and that chiefly in the island of Reil and Broca's convolution (left inferior-frontal); while the ascending-frontal gyrus, the paracentral lobule, the second-temporal gyrus, and the parietal and occipital lobes are usually free from change. The loss of fibres is first apparent in the superficial layers.

In one case of chronic basal meningitis MANZ (*Graefe's Arch. f. Ophthalm.* 1883) met with large endothelial growths in the pial sheath of the optic nerve, the nerve itself being atrophied.

On the morbid changes in the brain in progressive paralysis (general paralysis of the insane):—MEYNERT, *Viertelj. f. Psych.* 1868; WESTPHAL, *Arch. f. Psych.* I.; SIMON, *ibid.* II.; GREIFF, *ibid.* XIV.; ZACHER, *ibid.* XIII., XIV.; MESCHEDÉ, *Virch. Arch.* vols. 34, 56; TIGGES, *Allg. Zeitschr. f. Psych.* XX.; SCHÜLE, *ibid.* XXV.; LUBIMUFF, *Virch. Arch.* vol. 55, *Arch. f. Psych.* 1874; MIERZEJEWSKY, *Études sur les lésions cérébrales dans la paralysie générale* Paris 1875, *Arch. de physiol.* 1876; VOISIN, *Traité de la paral. gén. des aliénés* Paris 1879; MENDEL, *Die progr. Paral. d. Irren* Berlin 1880, *Berl. klin. Woch.* 1882, *Neurol. Centralb.* 1883; SCHULTZE, *Arch. f. Psych.* XI.; SELVILI, *Zur path. Anat. d. Dementia paral.* In. Diss. Zürich 1876; LUYs, *Gaz. méd.* 33, 1876; KLEBS, *Prag. med. Woch.* 1879; EMMINGHAUS, *Allg. Psychopathologie* Leipzig 1878; TUCZEK, *Dementia paralytica* Berlin 1884; KRÄPELIN, *Arch. f. Psych.* XV. 1884; HARTMANN, *ibid.* XVI. 1885 (mental disorder following injury to the head).

On like changes in the cord:—TÜRCK, *Wiener Sitzungsber.* LI., LII., LVI.; WESTPHAL, *Virch. Arch.* vols. 39, 40; MAGNAN, *Gaz. des hôpitaux* 14, 1876; STEWART, *Glasgow Med. Journ.* 1886.

657. The **ætiology** of hæmatogenous chronic meningoencephalitis is in many respects imperfectly understood. Hereditary predisposition, severe mental labor, exciting or exhausting influences of every kind, etc. have all been observed as antecedent conditions, and in such cases the hypothesis of an infective or toxic exciting cause seems to be excluded: such a cause is conceivable only in cases where the process is associated with diseases like cerebrospinal meningitis, typhoid, erysipelas, articular rheumatism, etc. And even here the secondary affection may well be the result of disordered nutrition rather than of any special extension of the primary disease.

Most cases of chronic meningoencephalitis and meningomyelitis would thus appear to be in their inception mainly dependent on degenerative changes due to excessive functional activity or to disorder of the circulation.

In recent cases of mental disorder presenting the same symptoms as the lesion we are considering, that is to say in what is clinically progressive paralysis, the changes found are frequently degenerative only, little if any evidence of inflammatory disease being discoverable. White turbidity of the pia mater is the chief of these changes, and it is due to an accumulation in the tissue of small globules and granules of fat, fatty and broken-down cells, and occasionally fat-granule cells. This detritus cannot have been wholly produced at the points where it is found by the degeneration merely of the meningeal endothelium or of extravasated cells; it must at least in part be derived from the brain-substance: and as a fact like matters are found in small quantity in the pial sheaths of the cortical vessels, while the vessel-walls themselves show here and there spots of fatty degeneration. It is also of special interest to note that some of the ganglion-cells are likewise fatty.

It often happens that no signs of inflammation appear at the sites of degeneration, though there are often small hæmorrhagic extravasations or pigmentary deposits to indicate that the circulation has been disturbed. It must be remembered that congestive hyperæmia alone, such as frequently accompanies excessive functional activity, is capable of increasing the intracranial pressure, and thus of compressing the capillaries, retarding the circulation, and bringing about local anæmia and engorgement with all their consequences.

But although simple disturbances of circulation and nutrition play an important part in the causation of progressive paralysis, it must not be forgotten that in other parts of the brain or cord, such as the centrum ovale or the columns of gray matter, close examination may reveal collections of leucocytes in the adventitial sheaths of the vessels. These

are sometimes very abundant, and can hardly be regarded as mere accumulations from stasis in the lymphatics, but are almost certainly evidence of inflammation. The occasional combination of multiple sclerosis (like that of recent encephalitis and myelitis) with meningo-encephalitis is of interest as showing that the process is one which in some instances at least is not limited to the cortex, but affects the whole central nervous system. As the disease becomes more advanced, the evidences of inflammation become more numerous, a result probably of the continuous action of the same exciting causes as first induced it.

These observations hold of a number of the cases: in others the inflammatory nature of the lesion is apparent from the commencement. Some acute cases are indeed described in which *post mortem* the hyperæmia and saturation of the brain with liquid effusion were unmistakable.

Chronic leptomeningitis is somewhat frequently associated with exudative pachymeningitis (Art. 664).

The apparent prominence of the neuroglial meshwork with its stellate cells in the atrophied portions of the cortex is at first due simply to the disappearance of the nerve-elements. Later on an actual multiplication and hyperplasia of the neuroglia-cells may take place, as in other atrophies of nerve-tissue.

The occasional combination of meningoencephalitis with degeneration and sclerosis of the posterior columns of the cord would indicate that the latter lesion is secondary, resembling in origin those changes we have already described. The spinal pia mater when it is affected at all is apt to be most thickened over the posterior half of the cord, and this has probably something to do with the locality of the sclerosis. The degeneration of the pyramidal tracts which is sometimes met with in the disease is perhaps dependent on the degeneration of the motor centres in the cortex (FLECHSIG), though this is questioned by WESTPHAL (Art. 647).

Chronic leptomeningitis of the cord alone, apart from the secondary forms dependent on inflammation of the dura mater, vertebræ, or cord-substance, is most commonly a termination of an acute attack. Most writers state that it may also be due to catching cold, and it sometimes follows mechanical injury. It is marked by the presence in the soft membranes of opacities, thickenings, and adhesions to the dura mater, and at times by increase and turbidity of the subarachnoid liquid. Marginal sclerosis, multiple sclerosis, and degenerations of some of the columns are occasionally present in the same case.

#### *Cicatrization and Sclerosis.*

**658. Repair of wounds of the brain and cord.** Bruises, cuts, stabs, and gun-shot wounds of the brain are usually fatal from the supervention of purulent meningitis and encephalitis. More rarely

abscesses are formed which are evacuated and healed up by granulation and cicatrization. It is only when the wound is aseptic or is at once protected from septic infection that we can expect healing without supuration.

The destructive changes set up by a traumatic lesion vary with its nature. Bruises and contusions are the most dangerous, stabs and punctures the least so.

When the brain is punctured (Fig. 274 *a*), as by a dagger-wound, in the first place hæmorrhage takes place, and the tissue immediately contiguous is thereby destroyed. A patch of anæmic or hæmorrhagic necrotic softening (*b*) is thus produced, the meninges overlying the part being usually infiltrated with blood.

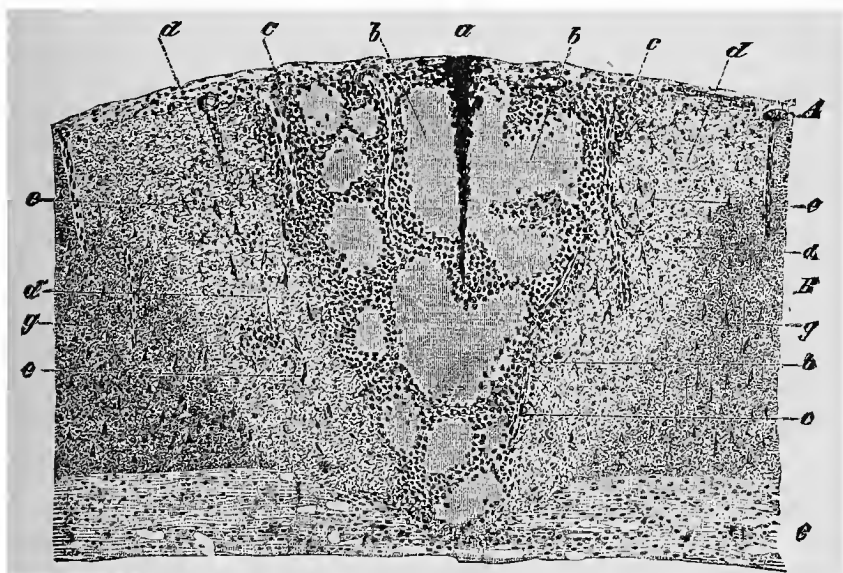


FIG. 274. ENCEPHALITIS EXPERIMENTALLY PRODUCED BY A PUNCTURE.

(From a rabbit's brain 12 days after the injury: section hardened in Müller's liquid, stained with hæmatoxylin and neutral carmine, and mounted in Canada balsam:  $\times 25$ .)

A, meninges

B, cortex

C, white matter

a, puncture

d, zone of degeneration

b, necrotic tissue, granular and denucleated

e, swollen and degenerate ganglion-cells

c, zone of inflammatory cellular infiltration

g, normal cortical substance

At the boundary between living and dead tissue a more or less intense inflammation (*c*) sets in after a few hours, and this by degrees constitutes a zone of demarcation. The inflammatory process advances mainly along the vessels (*c*) entering from the pia mater, and in a few days the inflamed tissue softens and liquefies, while the inflammatory cellular infiltration extends more and more into the necrotic patch (*b*). The

latter also liquefies and is absorbed, though months or years may pass before all the detritus is carried off.

Around the inflamed region the nerve-substance suffers from impaired nutrition, and a considerable portion of it undergoes degeneration (*d*), indicated by swelling, fatty change, fragmentation and disintegration of the ganglion-cells (*e*) and nerve-fibres. The inflammatory zone is thus surrounded by a broad zone of degeneration.

During the first few weeks the inflammatory zone is chiefly made up of vessels, small round-cells, larger formative cells, and fat-granule and pigment-carrying cells. The latter are always very abundant so long as absorption of the products of disintegration and extravasation goes on, the fat-granule cells being visible also in the zone of degeneration. After some weeks or months new fibrous tissue is gradually elaborated, plainly starting from the vessels that enter the inflamed region from the pia mater: the necrotic region is thus more and more surrounded and at length filled up with new-formed fibrous tissue. The fibres are sometimes close-set and wavy, sometimes loose and areolar, and are the product of the fibroblasts derived from the extravasated leucocytes and the connective-tissue cells of the pia mater and the vessel-sheaths.

This **cicatrization** is a very slow process, and after months or years the scar may still contain multitudes of round-cells. The encapsuled necrotic patch only disappears after the lapse of many months, and the degenerative changes external to the inflamed region persist as long or longer. Rarely does the degeneration result in fibrous hyperplasia and sclerosis, though when this happens the sclerosis is apt to be very extensive. In like manner the fibrous thickening of the wounded pia mater often extends over a large area.

This is the process of repair in comparatively small wounds: it is of course modified if there has been extensive laceration of the brain-tissue. As we mentioned in Art. 645 in speaking of contusions, the development of fibrous tissue is apt to be slight and incomplete, and the process takes the form of progressive **ischæmic softening**.

This account of the repair of the wounds of the brain is based partly on observations made by the author on human injuries, partly on experiments made for him by KAMMERER upon rabbits. The process of healing can be readily followed in punctured wounds made under antiseptic precautions with recently heated needles. The oldest wound examined in a patient was 21 months old, and was due to a knife-stab penetrating the ascending-frontal convolution of a young man. The necrotic patch was not then fully absorbed, and the scar was still surrounded by a broad zone of degeneration, which like the scar contained numerous fat-granule and pigment-carrying cells.

References:—BRUNS, *Die chir. Krankheiten u. Verletz. d. Gehirnes u. s. Umhüllungen* Tübingen 1854; STROMEYER, *Verletz. u. chir. Krankh. d. Kopfes* Freiburg 1864; BERGMANN, *Deutsche Chirurgie* part 30; VIRCHOW, *Virch. Arch.* vol. 50; GLUGE, *Abhandl. z. Physiol. u. Path.* Jena 1841 (experiments on encephalitis); HASSE and KÖLLIKER, *Zeitschr. f. rat. Med.* IV. (1846); JOLLY, *Stud. aus d.*

*Inst. f. exp. Path.* Vienna 1870; HAYEM, *Etudes sur les diverses formes d'encéphalite* Paris 1868; KLEBS, *Path. Anat. d. Schusswunden* Leipzig 1872; ZIEGLER, *Sitzungsber. d. phys.-med. Gesell. in Würzburg* 1878.

659. Both in the brain and cord we meet with localized or disseminated hæmatogenous inflammation, which like the localized degenerations lead partly to permanent loss of substance, partly to gray degeneration and sclerosis. **Encephalitis** is the name given to the affection of the brain, **myelitis** to that of the cord.

It is in the first place to be kept in mind (Art. 653) that in epidemic cerebrospinal meningitis patches of encephalitis and myelitis are of constant occurrence. In the meningitic processes associated with progressive paralysis inflammatory foci are found in the interior of the brain and cord, and sometimes in the pial sheaths of the nerve-roots. But these deeper inflammations also take place in the absence of meningitis, both in connection with infective disorders and idiopathically.

Thus in typhoid, variola, acute rheumatism, pyæmia, puerperal fevers, ulcerative phthisis, etc. multiple encephalitis is not rare, while in hydrophobia (so-called *lyssa*) patches of inflammation scattered through the whole central nervous system, but chiefly in the base of the brain and the cord, have been described by a number of writers (KOLESSNIKOW, FOREL, GOWERS, WELLER). They are very common in tuberculosis (Art. 660).

Frequently too these patches occur without any apparent exciting cause, and are then attributed vaguely to cold or some such injurious influence. According to certain authorities violent irritation of peripheral nerves is capable of setting up myelitis; though it is more likely that the spinal diseases thus induced are due to ischæmic or hæmorrhagic softening.

The smaller and more recent patches are not visible to the naked eye, being little more than circumvascular cellular infiltrations. When they are somewhat larger they are usually seen as red or pink spots, which are very distinct when in the white matter. Sometimes they contain little extravasations, and under certain conditions the whole patch resembles one of hæmorrhagic softening.

The smaller patches occasionally heal without leaving a trace. In the larger ones there is always some destruction of nerve-tissue, a small cyst (Art. 642), a gray gelatinous patch (Fig. 271, Art. 650), a sclerosis, or a scar remaining after the cessation of the inflammatory disturbance and the absorption of detritus and exudation.

In the brain recent **multiple encephalitis** is found in many acute mental disorders: sometimes the patches are extraordinarily numerous. As to the issue of this form of disease we know little, though it is possible that it terminates in multiple sclerosis. As to the larger myelitic foci and their consequences we are better informed.

In the first place the cord is subject to acute inflammation affecting

chiefly the gray matter, and described as central myelitis or poliomyelitis (*πολιος* gray). **Anterior poliomyelitis** is the commonest form (Figs. 275, 276), the inflammation being limited to one or both anterior horns. More rarely it extends to the posterior horns or to the entire section of the gray columns (Fig. 277).

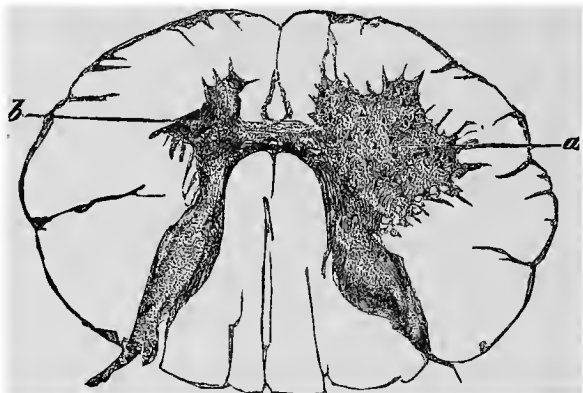


FIG. 275. SCLEROSIS AND SHRINKING OF THE LEFT ANTERIOR HORN.

(Section taken at the level of the fourth cervical nerve from a case of *infantile paralysis (acute anterior poliomyelitis)* in a child of 3½: hardened in Müller's fluid, stained with neutral carmine, and mounted in Canada balsam:  $\times 7$ .)

a, normal anterior horn with ganglion cells  
b, atrophied and shrunken horn

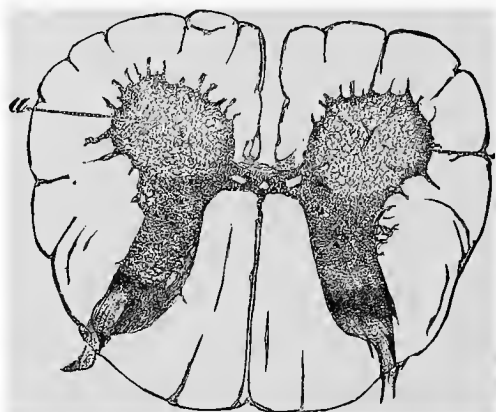


FIG. 276. GELATINOUS DEGENERATION OF BOTH ANTERIOR HORNS.

(Section taken from lumbar region: case of *acute anterior poliomyelitis* in a man of 40: preparation treated as in last figure:  $\times 6$ .)

a, anterior horns

The disease chiefly attacks children less than four years old, and hence the clinical name of **infantile spinal paralysis**; it is rare in adults. Its onset is acute, there is usually fever, and soon paralysis, which in

the course of a week passes away to some extent. So far as our knowledge goes the inflammation is hæmorrhagic in character, and gives rise to functional disorder partly by destruction of tissue and partly by pressure. The preference shown for the anterior columns and especially for the inner two-thirds of each appears to be due to the fact that these parts constitute a special vascular territory distinct from the white matter. The length of the affected region varies from about 0.5 to 4 centimetres, though cases occur in which much larger segments of the cord are attacked.

The number of ganglion-cells and nerve-fibres destroyed depends on the severity of the inflammation: sometimes indeed the whole of the nerve-tissue perishes outright.

In the course of weeks or months the exudation and the products of disintegration are absorbed. If the neuroglia as well as the nerve-elements is destroyed a small cyst is formed. If the neuroglia persists and

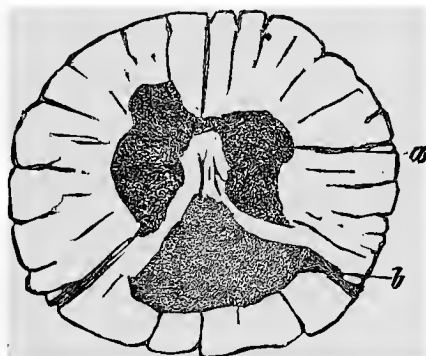


FIG. 277. SCLEROSIS AND SHRINKING OF THE ENTIRE GRAY MATTER.

(Section taken from lower dorsal region of a man of 30 suffering from acute anterior poliomyelitis: preparation treated as in last figure:  $\times 6$ .)

a, site of gray matter

b, sclerosis of posterior columns

undergoes a moderate hyperplasia, the substance of the anterior horn is transformed into a gray gelatinous mass (Figs. 271, 276), consisting of a loose reticulum containing liquid in its wide meshes. When the hyperplasia is considerable the tissue becomes close-textured, firm, and sclerotic (Fig. 275), consisting of a felted mass of fine fibrils with scattered nuclei. The vessel-walls are in general thickened, the adventitial lymph-spaces are dilated, and contain at least in the earlier stages round-cells and granular cells. When the nerve-elements are not entirely destroyed the sclerotic tissue still encloses a few ganglion-cells (Fig. 278 b) and nerve-fibres.

The anterior roots and the peripheral motor nerves become atrophied when the ganglion-cells are destroyed, and assume a gray wasted appearance. The muscles supplied by them likewise atrophy.

When the inflammation affects the gray matter over its whole cross-section, the horns become after a time strangely warped and distorted, and presently undergo gelatinous degeneration or sclerosis (Fig. 277).

The white columns are frequently affected by secondary extension of inflammation from the gray matter. Sometimes however the white matter is inflamed from the beginning, and we have **leukomyelitis** (*λευκος* white) associated with poliomyelitis. In such cases the whole cross-section of the cord or the greater part of it undergoes destructive inflammation (**transverse myelitis**), and afterwards gelatinous and sclerotic changes (Fig. 278). The disease moreover frequently extends over a considerable segment of the cord. Secondary ascending and descending degeneration of the tracts after a time follows on the local lesion.

Myelitic foci are usually single, though sometimes they are multiple, as in disseminated myelitis. The multiple patches are usually small, and may be scattered throughout the whole cord. When myelitis

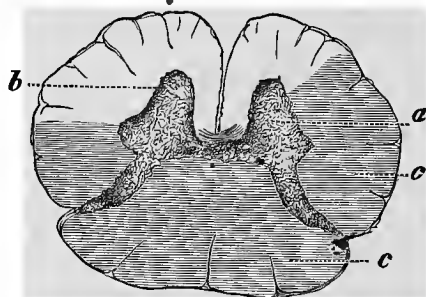


FIG. 278. SCLEROSIS AFTER ACUTE TRANSVERSE MYELITIS.

(Section taken from a man of 40 at the level of the lower dorsal region : hardened in Müller's fluid, stained with carmine, and mounted in Canada balsam :  $\times 6$ .)

- a, gelatinous change in gray matter
- b, surviving ganglion-cells
- c, atrophied and sclerotic white matter

attacks the region of the bulbar nuclei it gives rise to acute **glossolabio-pharyngeal or bulbar paralysis**.

Under conditions analogous to those which lead to acute poliomyelitis in children we may apparently have an acute inflammation of the cortical gray matter or **acute polioencephalitis** (STRÜMPPELL), the result of which is **infantile cerebral paralysis**. In its later stages it is characterized by loss of substance in the convolutions, resembling the congenital condition known as porencephalia (Art. 630).

BENEDIKT (*Virch. Arch.* vol. 64), KOLESSNIKOW (*ibid.* vol. 85), FOREL (*Zeitschr. f. Thiermed.* III.), ALLBUTT (*Trans. Path. Soc.* XXIII. 1872), GOWERS (*ibid.* XXVIII. 1878), ROSS (*ibid.* XXX. 1880), COATS, *Med. chir. Trans.* LXI. 1878), and WELLER (*Arch. f. Psych.* 1879) all agree in stating that in **hydrophobia** circumvascular

extravasations, some of them hæmorrhagic, are found in the central nervous organs. BENEDIKT, KOLESSNIKOW, GOWERS, and WELLER also discovered circumvascular hyaline and granular coagulated masses formed from the extravasated elements of the blood, together with venous thromboses (BENEDIKT), and patches of 'granular' degeneration. FOREL was not able to verify these observations.

LANGHANS (*Virch. Arch.* vol. 64) found in the cord in cases of **tetany** certain circumvascular patches of cellular infiltration. NAUWERCK in a recent case of **chorea minor** with endocarditis observed small patches of inflammation situated chiefly in the medulla; these were combined with certain degenerative changes in the brain and cord. Myelitis is said to occur among the Kabyles in North Africa as a result of eating the pulse of *Lathyrus cicera*: see Art. 648, and MARIE (*Progrès médical* 1883), PROUST (*Bulletin de l'acad. d. méd.* XII. 1884).

The number of white blood-cells usually present in the brain (DUKE KARL THEODOR of Bavaria, *Virch. Arch.* vol. 69) is increased in typhoid (POPOFF), but not necessarily owing to inflammation. Sometimes, though rarely, disseminated encephalitis is associated with typhoid.

STEUDENER (*Beit. z. path. Anat. d. Lepra mutilans* 1865), NEUMANN (*Skin diseases*, trans. by PULLAR, London 1871), TSCHIRJEW (*Arch. d. physiol.* 1879), and LANGHANS (*Virch. Arch.* vol. 64) found inflammatory foci in the cord in connection with anæsthetic leprosy. See also STURGE, *Brain* VII. 1885.

ERB and others affirm that in infantile spinal paralysis the inflammatory disturbance extends over the whole of the anterior columns, reaching its greatest intensity only at certain parts, and the wide-spread initial paralysis corresponds with this view of the case. After weeks or months however only circumscribed changes can be demonstrated, the extent of which varies with the extent of the persistent paralysis. When certain muscles only are paralyzed, certain spots only of the anterior horns are found to be degenerate.

References on myelitis:—CHARCOT, *Diseases of the nervous system* London 1880; LEYDEN, *Klinik d. Rückenmarkskr.* 1874-76, *Zeitschr. f. klin. Med.* I., *Arch. f. Psych.* VI.; HAMMOND, *Diseases of the nervous system* London 1876; ERB, *Ziemssen's Cyclop.* XIII.; SCHULTZE, *D. Arch. f. klin. Med.* XX., *Virch. Arch.* vol. 68; DUJARDIN-BEAUMETZ, *De la myélite aiguë* Paris 1872; WESTPHAL, *Arch. f. Psych.* III., IV. (1874); HAYEM, *Arch. de Physiol.* VI. (1874); LAVERAN, *ibid.* VII. (1875); BAUMGARTEN, *Arch. d. Heilk.* XVII.; HAMILTON, *Quart. Journ. of micro. science* 1875; TURNER, and HUMPHREYS, *Trans. Path. Soc.* XXX. 1879 (recent cases of poliomyelitis); DAMASCHINO and ROGER, *Gaz. méd.* 1871 (ditto); BARLOW, *On regressive paralysis* London 1878; ALTHAUS, *Infantile Paralysis* London 1878; ANGEL-MONEY, *Trans. Path. Soc.* XXXV. 1884; DRUMMOND, *Brain* VII. 1885; KRAUS, *Poliomyelitis anter. acuta* In. Diss. Tübingen 1882; SAHLI, *D. Arch. f. klin. Med.* XXXIII.; ETTER, *Corresp. f. Schweiz. Aerzte* 1882 (acute bulbar myelitis); LANGE, *Hosp. Tidende* 1868 (ditto); LEYDEN, *Arch. f. Psych.* VII. (ditto); LICHTHEIM, *D. Arch. f. klin. Med.* XVIII. (ditto); EISENLOHR, *Virch. Arch.* vol. 73; VON VELDEN, *D. Arch. f. klin. Med.* XIX. (disseminated myelitis); ENGELKEN, *Path. d. acuten Myelitis* In. Diss. Zurich 1867 (ditto); DRESCHFELD, *Lancet* 1, 1882 (ditto).

LEYDEN (*Arch. f. Psych.* VIII. 1877, *Charite-Annalen* III.) produced myelitis in dogs by injecting liquor arsenicalis (Fowler's solution) into the lumbar cord, and showed that the affection might terminate in cicatrization, sclerosis, cyst, or in simple rarefaction or loosening of the tissue. He thought that disseminated multiple sclerosis was the result of a disseminated myelitis or encephalitis. Clinically the term myelitis is used in a sense much wider than that to which we have restricted it. Thus poliomyelitis is used to describe conditions which are not

inflammatory, such as ischæmic and hæmorrhagic softening, simple atrophy, and multiple sclerosis of the gray matter. Secondary and primary tract-degenerations, ischæmic and hæmorrhagic softening, degeneration from pressure and contusion of the white matter of the cord or medulla oblongata, are all classed as myelitis. This may be convenient, but the pathologist is bound to be more discriminating. Even if it is not always possible in the post-mortem room to determine with certainty the manner in which a given change, say a patch of sclerosis, was initially induced, this is no reason for declining to classify such changes according to their mode of origin.

The terms acute and chronic progressive bulbar paralysis, anterior poliomyelitis, infantile spinal paralysis, atrophic spinal paralysis, transverse myelitis, leukomyelitis, protopathic and secondary spinal muscular atrophy, spastic spinal paralysis or paraplegia, and so on, are intended to express the character of the clinical symptoms and the seat of the lesion in the several maladies: for the most part however they fail to indicate or at least to indicate correctly the nature of the morbid process.

On acute polioencephalitis:—STRÜMPPELL, *Deut. med. Woch.* 1884, *Jahrb. f. Kinderheilk.* XXII. 1885, *London Med. Record* 1885; GAUDARD, *L'hémiplégie infantile cérébrale* In. Diss. Geneva 1884; RANKE, *München. med. Woch.* 18, 1886; WOLFENDEN, *Practitioner* XXXVII. 1886.

## CHAPTER XCVI.

### TUBERCULOSIS AND SYPHILIS.

660. **Tuberculosis** of the central nervous organs and their membranes is in most cases embolic in origin, though the disease may also extend by continuity from neighboring tissues, such as the bones.

When the tuberculous virus reaches the brain or cord by way of the blood-vessels a form of tuberculosis is set up which we may call **disseminated tuberculous meningoencephalitis** or **meningomyelitis**. Where the bacilli first lodge their irritative action gives rise to minute inflammatory foci (Fig. 279, *c e f*), which in the subarachnoid and pia mater and in the substance of the brain and cord are distributed chiefly along the course of the small veins, in part also amid the capillaries of the nerve-substance itself. The pial sheaths (*f*) of the vessels are at first the chief seat of the inflammatory infiltration of cells; presently however the process extends also to the adjacent tissues (*e*). In a short time the collections of cells form nodules (*d*) and nodular clusters (*a b*), or more rarely larger continuous patches (*k*).

Disseminated embolic tuberculosis of the brain and cord runs in general a somewhat rapid course, and proves fatal in a few weeks' time. In addition to the nodular eruption there is often wide-spread diffuse inflammatory exudation of a sero-purulent or fibrino-purulent character, the pus infiltrating the meninges and the brain-substance, and often accumulating in the ventricles. It is only in rare cases and these very chronic (Fig. 279) that diffuse exudation fails to accompany an abundant eruption of tubercles.

In the soft membranes the first visible sign of tuberculosis is the appearance of small gray nodules usually lying along the course of congested vessels. By and by they become larger, and the subarachnoid spaces are seen to contain a turbid yellowish-white pus-like exudation. When the choroid plexuses are invaded they too contain gray nodules, and are swollen and infiltrated with a turbid liquid. The ventricles are more or less distended with the like exudation; sometimes they are enormously dilated, and the brain-substance thereby so compressed that the convolutions are flattened and the subarachnoid liquid expressed, leaving the arachnoid surface dry.

The completely-developed tubercles in the nerve-tissue appear as little nodules, gray and translucent, or yellowish-white with a gray periphery.

Quite recent continuous patches of tuberculous infiltration have a red-dish tint, like other inflamed parts.

Tubercles may appear in any part of the meningeal or nervous tissue. If growing near a vein they are seen to penetrate not only the adventitia but the inner coats, until the lumen of the vessel appears closely beset and encircled with the accumulated cells. The white blood-cells inside the vessel are often arranged peripherally, and sometimes visibly distend it.

Arteries running through tuberculous foci have first the adventitia

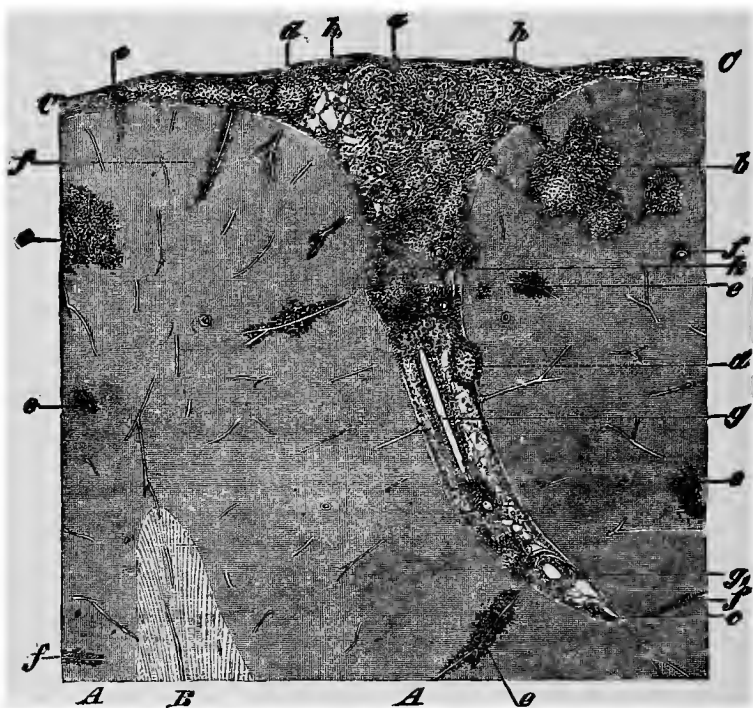


FIG. 279. CHRONIC DISSEMINATED TUBERCULOUS MENINGOENCEPHALITIS.

(Section hardened in Müller's fluid and alcohol, stained with alum-carmin, and mounted in Canada balsam:  $\times 10$ .)

	A, cortex	B, white matter	C, meninges
a,	dense fibro-cellular mass of tubercle in the subarachnoid tissue	f,	cellular infiltration of pial sheath of cortical vessels
b,	tuberculous mass in the cortex	g g <sub>1</sub> ,	longitudinal and transverse section of an artery
c,	small tubercle in the pia mater	h,	diffuse fibro-cellular thickening of the subarachnoid tissue
d,	isolated tubercle in the subarachnoid tissue		
e,	circumscribed infiltration in the cortex, an early stage of tubercle		

invaded and infiltrated with cells; then the media and intima are attacked, especially the latter, which is sometimes so thickened by the infiltrating cells that the lumen of the artery is encroached on and ob-

structed. If then the white blood-cells gather at the diseased spot and form a thrombus the occlusion becomes complete.

Tubercles in the brain or cord very rapidly undergo caseation, and only in chronic cases (Fig. 279) are large formative cells developed in appreciable numbers: in such cases the mature tubercles assume the large-celled coarse-textured appearance of those growing in lymphatic glands (Art. 342). When caseation begins in a tuberculous focus lying near a vessel of moderate size it generally extends to the walls and to the cellular contents of the vessel.

The commonest seat of embolic tuberculosis is about the basal branches of the sylvian artery: the disease is generally bilateral, though often more extensive on one side than on the other, and cases are not wanting in which it is unilateral. When the bacilli reach the arterial branches that pass upwards from the sylvian fissure to the surface of the cerebrum they give rise to more or less extensive meningitis of one or both sides of the convexity.

The territory of the arteries of the median plane of the cerebrum, cerebellum, medulla, and cord may in like manner be infected, and though this does not occur so frequently as in the case of the basal regions it is by no means rare.

When the eruption is abundant the chief mass of tubercle is usually to be found in the soft membranes of the brain and cord; but the nerve-substance hardly ever escapes entirely. The disease of the pia mater extends to the cortex as a diffuse cellular infiltration, leading to destruction of the nerve-elements, often preceded by a remarkable swelling of the axis-cylinders and of the ganglion-cells. In like manner the cranial and spinal nerves are attacked, the cellular infiltration reaching the pial sheaths, and thence spreading along the fibrous septa into the substance of the nerves, and often inducing degeneration of the nerve-fibres.

In addition to this meningeal invasion we frequently meet with tubercles growing directly in the deeper parts of the substance of the brain and cord: even in cases described as tuberculous meningitis the number of encephalitic and myelitic foci is at times very considerable; they are overlooked simply because they are apt to be very small.

If the bacilli lodge in a few branches only of the meningeal or cerebral arteries the first eruption of tubercles is scanty. But as the patient does not usually die at once, the tubercles grow and coalesce into large masses lying beneath the pia mater or in the midst of the nervous tissues. In the subarachnoid spaces and in the pia mater they form flat discoid masses of various sizes, and in the brain-substance rounded nodes, sometimes as large as a walnut or even a hen's egg. These are sometimes described as **solitary tubercles**. Their centres are yellowish-white and caseous, being sometimes firm and dense, sometimes soft and semi-liquid, rarely calcified. Their peripheral parts consist of grayish-red or semi-translucent granulation-tissue, often enclosing typical miliary tubercles,

The larger tubercles are developed from the smaller by the continued growth of new granulomatous tissue, sometimes containing multitudes of giant-cells, sometimes none at all. It is remarkable that where the inflammatory process is going on the fibrous elements of the brain-tissue often undergo marked hyperplasia, and form thus a coarse fibro-cellular tissue. Tubercle-bacilli can be demonstrated both in the gray granulomatous zone and in the older portions of the growth.

Solitary tubercles are most frequently observed in the cerebellum and cerebral axis. They act like tumors on the neighboring tissues, giving rise to symptoms of pressure and to disturbance of the circulation both of blood and lymph. The other parts of the central organs may be entirely free from tubercle, though it often happens that tuberculous matter passes from the solitary nodes to the meningeal vessels and gives rise to disseminated and diffuse tuberculous meningitis. It is also of course possible for a fresh infection of the blood to take place, and in consequence a fresh embolic eruption of tubercles.

The situation of tuberculosis of the central nervous organs due to extension of tuberculous disease from contiguous parts is of course dependent on the seat of the primary affection. Tuberculous disease of the vertebræ infects the cord and its membranes, tuberculosis of the petrous bone extends in the first place to the temporal lobes and the basal aspect of the frontal lobe. Nodules appear in the affected regions, and these in time may grow into larger nodes. If the virus gain access to the cerebrospinal lymph-channels it may give rise to disseminated tuberculosis.

Many authorities (VIRCHOW, RINDFLEISCH, BIRCH-HIRSCHFELD, etc.) state that meningeal and cerebral tubercles lie usually in the adventitia of the arteries, and there form clusters of cells derived by multiplication from the endothelium of the lymphatics. They base this statement on the fact that in tuberculous meningitis collections of cells are found in the adventitia of the cortical arteries. This interpretation of the fact is however erroneous. The tubercles are developed from extravasated leucocytes and proliferous connective-tissue cells. The adventitia is affected and takes part in the proliferation only in a secondary way, and what has been described as a tubercle due to periarteritis of a pial vessel is in fact only a fraction of a tubercle growing near the vessel. In other inflammations of the pia mater and cortex we find like cellular infiltrations of the pial sheaths of the vessels, though it must not be overlooked that in tuberculous and syphilitic (Art. 661) inflammations the arteries take part in the cellular hyperplasia to a much greater extent than in other forms of inflammation. The like is true also of the endarteritic processes.

References:—VIRCHOW, *Cellular Pathology* London 1860, *Krankh. Geschwülste* II. Frankfurt 1856; WILKS, *Path. Anat.* London 1875; RINDFLEISCH, *Virch. Arch.* vol. 24, *Path. Histology* II. London 1873; HUGUENIN, *Ziemssen's Cyclop.* XII.; VON CAMPE, *Beitr. z. path. Anat. d. meningit. u. meningo-encephalit. Processe* Tübingen 1882.

661. **Cerebrospinal syphilis** usually makes its appearance some years after the disease has become 'constitutional,' that is to say,

simultaneously with the so-called tertiary symptoms: it is rarely an accompaniment of secondary symptoms. The characteristic morbid change is the formation of circumscribed inflammatory foci, or **gummata** as they are called, in the meninges and cortex, very rarely in the interior of the brain or cord. As a rule they lie in the pia mater and subarachnoid tissue of the base of the brain.

The first thing observed in the meninges is a small patch of inflammation, which soon leads to the formation of a gray or grayish-red semi-translucent or gelatinous knot of granulation-tissue (Fig. 280). In the earlier stages the tissue of the knot is extremely cellular (*f*), and contains a number of new-formed capillaries. As the process goes on some of the granulation-tissue becomes-fibro-cellular (*d*<sub>1</sub>) and some undergoes

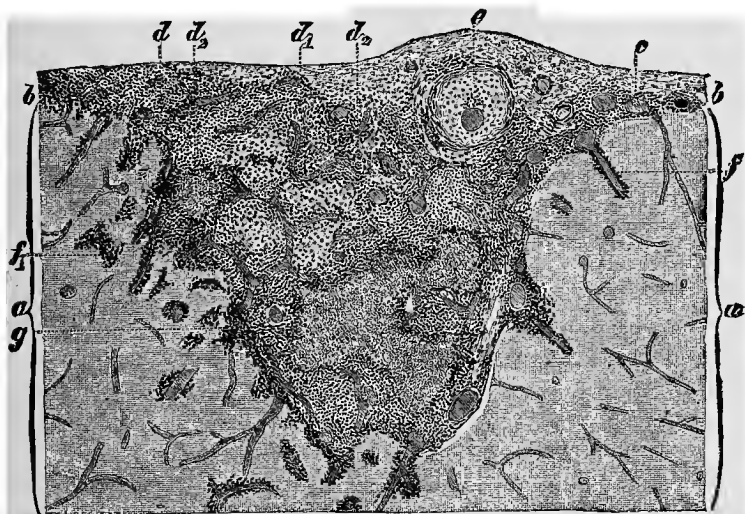


FIG. 280. GUMMATOUS SYPHILITIC MENINGOENCEPHALITIS.

(Section hardened in Müller's fluid and alcohol, stained in alum-carmin, and mounted in Canada balsam:  $\times 15$ .)

- |  |  |
|--|--|
| a, cortex  | e, artery with thickened intima and infiltrated adventitia           |
| b, pia mater   | f, cellular infiltration of the pial sheaths of the cortical vessels |
| c, vein surrounded by cellular exudation   | g, diffuse infiltration extending into the cortical substance        |
| d, recent and cellular, d <sub>1</sub> fibro-cellular, d <sub>2</sub> caseous granulation-tissue |  |

caseation (*d*<sub>2</sub>). The adjacent brain-substance seldom or never remains intact, the inflammation extending into the cortex along the pial sheaths of the vessels (*f*) and also directly (*g*). When arterial branches (*e*) pass through the granulomatous focus they are speedily infected, the adventitia, media, and intima becoming the seat of inflammation leading to cellular infiltration and fibro-cellular hyperplasia of the vessel-walls, according to the stage of the process. The intima (*e*) usually takes part

to a remarkable extent in this hyperplasia, the thickening being often so great that the vessel is much obstructed or even occluded outright. The latter event is most apt to occur when thrombosis accompanies the endarteritis.

Gummatous foci may be either single or multiple. The single foci are sometimes very small; HEUBNER indeed has shown that the specific inflammation may be limited to single spots on the arterial walls, and there lead to the thickening of the intima just described. Larger foci are however more frequent, and are described as nodes or gummata simply. In the earlier stages they are gray or grayish-red and soft, their form depending on the texture of the tissue in which they lie. On the surface of the brain they follow the course of the sulci and take their shape: in the sylvian fissure they are flat and elongated; about the base of the brain and the cord they have irregular forms. Sometimes about the basal meninges the syphilitic inflammation is more diffuse and not nodular. When it extends to the brain-substance and grows in size the diseased patch becomes more and more globular, and at times is as large as a walnut, though the periphery usually remains somewhat irregular. The same holds for the nodes which develop independently in the substance of the brain and cord.

The smaller foci can undoubtedly disappear by re-absorption: the larger ones become partly indurated and partly caseous. The caseation begins with the appearance of yellowish-white opaque spots, measuring from a few millimetres to some centimetres across according to the size of the node itself. When several such spots appear in the same node they give it a mottled appearance, until at length coalescing they form a yellow centre to the mass. Induration generally goes on simultaneously with caseation, though sometimes the latter is absent. It leads to scar-like thickening of the meninges, and to adhesions between the pia and dura mater. The coarse scar-tissue generally encloses caseous patches.

Where syphilitic inflammation is going on the nerve-elements of course perish; the process is frequently associated with ischæmic and hæmorrhagic softening of adjoining parts, consequent on the disturbance of the circulation induced by arteritis and compression. Occasionally these degenerative changes extend widely. Nerves passing through the inflamed region undergo inflammatory infiltration, and thereafter becoming enclosed and beset by coarse fibrous tissue they speedily atrophy and break down. Thus gummatous inflammation of the meninges at the lower end of the cord now and then leads to the enclosure of the greater number of the nerves of the cauda equina in a mass of granulation-tissue: this is presently transformed into a coarse cicatrix, and blended by adhesions with the dura mater forms a compact mass of scar-like tissue enclosing atrophied nerves and caseous patches. The same thing sometimes happens in the case of the cranial nerves.

Some nodes of the brain and cord which have been described as gummatous appear beyond a doubt to have been tuberculous. As the periphery and the neighborhood of these nodes do not always contain tubercles, before the discovery of the tubercle-bacillus it was not always easy to determine the nature of a given caseous mass. VIRCHOW has asserted that tuberculous nodes are rounded, while gummatous ones are irregular; but this criterion does not always hold good.

References:—VIRCHOW, *Virch. Arch.* vol. 15, *Krankhafte Geschwülste* II. 1869; LEON GROS and LANCEREAUX, *Des affections nerv. syph.* Paris 1861; ENGELSTEDT, *Die constitut. Syphilis* Würzburg 1861; WILKS, *Guy's Hosp. Rep.* IX. (1863); WAGNER, *Arch. d. Heilk.* IV. (1863); WESTPHAL, *Allg. Zeitschr. f. Psych.* XX. (1863); JAKSCH, *Prag. med. Woch.* 1864; LANCEREAUX, *Traité de la syphilis* Paris 1866 (trans. New Syd. Soc. II. London 1869); HEUBNER, *Arch. d. Heilk.* XI. (1870), *Die luetische Erkrank. d. Hirnarterien* Leipzig 1874, *Ziemssen's Cyclop.* XII.; GREENFIELD, *Trans. Path. Soc.* XXVIII., XXIX.; CHARCOT and GOMBAULT, *Arch. de physiol.* v. 1873; BRAUS, *Die Hirnsyphilis* Berlin 1873; BRUBERGER, *Virch. Arch.* vol. 60; WILKS and MOXON, *Path. Anat.* London 1875; BROADBENT, *Lancet* 1, 1874; BAUMGARTEN, *Virch. Arch.* vols. 73, 76, 86; VON RINECKER, *Festschrift z. Jubil. d. Würzburg. Universität* 1882; GREIFF, *Arch. f. Psych.* XII.; FOURNIER, *La syph. du cerveau* Paris 1879, *Leçons sur la syph.* (2d edition) Paris 1881; JULLIARD, *Etude critique sur les localis. spin. de la syph.* Paris 1879; WESTPHAL, *Charité-Annalen* i. (1876); GOWERS, *Hill and Cooper's Syphilis* London 1881; BUZZARD, *Lancet* 1, 1873 and *Brain* III. 1880, *Diseases of the nervous system* London 1882; DOWSE, *Syphilis of the brain and spinal cord* London 1881; ROSENTHAL, *D. Arch. f. klin. Med.* XXXVIII. 1886 (with numerous references).

## CHAPTER XCVII.

### TUMORS AND PARASITES.

662. Of the tumors occurring in the brain and spinal cord the **gliomata** (Art. 145, Fig. 40) claim our first notice. They are commonest in the cerebrum, more rare in the cerebral axis and in the cord: they lie usually close beneath the pia mater. In most cases the outer aspect of the brain-surface remains unaltered, the tumor appearing merely to cause enlargement and discoloration of the affected part, and perhaps some thickening of the meninges. It is seldom that the tumor takes the form of a definite protuberance.

On section the neoplastic mass consists sometimes of tissue not a little resembling pale or hyperæmic gray matter in tint and consistence, more commonly however the glioma is gray, grayish-white, grayish-red, yellow, or gelatinous in appearance, or mottled with all these tints and with spots of opaque white and of extravasated blood (Fig. 281 *b*); its consistence is in parts softer, in parts firmer than that of normal brain-tissue. Frequently it includes numerous vessels distended with blood, and of markedly larger calibre than the ordinary vessels of the part. When the hæmorrhages are numerous and extensive they may so stain and disguise the tissue that it looks like a patch of apoplectic extravasation. If the tissue is partly destroyed either by hæmorrhage or by softening the growth encloses cavities filled with turbid white or brown semi-liquid detritus.

Cerebral gliomata measure as much as 3 to 8 cm. across, or even more. The surrounding brain-substance is sometimes scarcely marked off from the substance of the tumor, sometimes is quite distinct and even visibly compressed: not infrequently it is softened and may contain cysts of disintegration. The ventricles are as a rule more or less dilated.

In the cord gliomatous tumors usually lie close to the central canal and spread thence posteriorly and externally. They are in general elongated, seldom globular, and may extend over a considerable length of the cord. Externally they give the cord a bulging or thickened appearance. Dilatation of the central canal and excavation of the growth itself are common (syringomyelia, Art. 635).

As we have mentioned in Art. 145 the tumor is made up of branched neuroglia cells, though the number and size of the cells present in dif-

ferent growths is subject to great variation. When they are small and scanty, and their ramifying fibrils numerous and closely felted, the texture is dense and firm: when the cells are large and numerous the tumor rather resembles a sarcoma.

The cells are in general uniformly scattered through the mass, but now and then they appear to lie in small clusters: multinuclear cells are common, especially in the peripheral parts of the growth.

The vessels are frequently much dilated (Fig. 41), and so abundantly developed that the tumor is fitly described as telangiectatic or angiomatic. The vessel-walls are often thickened and hyaline, and there is hyperplasia of the adventitia, the vessels being thus surrounded by a thick envelope of cellular and fibro-cellular tissue. Round the veins there may be accumulations of white blood-cells.

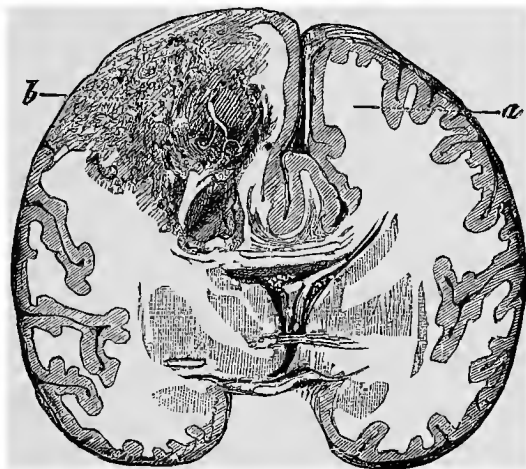


FIG. 281. ANGIOMATOUS GLIOMA.

(Frontal section through the brain.)

a, right hemisphere

b, glioma in left hemisphere

The tumor grows by proliferation of the neuroglia and multiplication of its cells: at least this is as much as can be made out by examination of the growing margin. The nerve-fibres as they are encroached on perish, their axis-cylinders becoming notably swollen before they break down. The ganglion-cells and their nuclei also swell in a remarkable way, and become homogeneous and glassy in appearance. Later on they break down like the nerve-fibres, though it is sometimes surprising how long both elements persist.

When the glioma presses on the pia mater the connective-tissue cells of the latter undergo subdivision and multiplication, and a new-formation of fibrous tissue usually takes place. The gliomatous growth may ultimately extend into the meshes of the fibrous tissue. In ischæmic and

hæmorrhagic softening of the growth the cellular elements perish, partly by necrosis and partly by fatty degeneration. Sometimes peculiar protoplasmic lumps, with or without nuclei, are produced, apparently by coalescence of some of the cells. Stratified corpora amylacea also occur in the tumor-tissue.

Sometimes a mucous liquid forms abundantly in the interstices of a glioma and give it the appearance of loose mucous tissue: such tumors are described as **gliomyxomata**. Still more frequently the connective-tissue cells undergo so marked a proliferation that the tumor becomes a **gliosarcoma**, the neuroglia-cells increase greatly in number and size, and ultimately lose their typical characteristics. In other cases the vascular adventitia becomes abnormally proliferous, and the product of its overgrowth is at length so abundant that the gliomatous structure is overshadowed. Gliosarcoma is chiefly characterized by the multiform character of its cells; but the overgrowth just alluded to results in a spindle-celled neoplasm, the cells being arranged along the course of the blood-vessels: it is therefore described as **angiosarcoma**. Sarcomatous transformation in a cerebral glioma gives the tumor a marrowy or 'encephaloid' consistency, and marks it off more sharply from the surrounding brain-substance.

**Sarcoma** also occurs as an independent growth, unattended at first by any multiplication of neuroglia-cells. Spindle-celled and multiform-celled varieties are the commonest, and they are in general soft and marrowy. They are commonly rounded, sharply defined, of all sizes, and either single or multiple. So far as we at present know they develop from the pial sheaths of the vessels and in part from the neuroglia. Hæmorrhage and softening of the tumor are frequent. If it lies close beneath the pia mater it often invades that membrane. The surrounding brain-substance is generally softened, the meninges inflamed, and the ventricles dilated.

Small **angiomata** are not uncommon in the brain, though they do not form regular tumors but only small reddish foci, not unlike recent patches of inflammation. They are probably congenital (VIRCHOW), and are of the same nature as vascular nævi. There is simply telangiectasis of the blood-vessels, not cavernous metamorphosis of the tissue (Art. 149). GANGUILLLET recently described as **cylindroma** a gelatinous-looking angioma of the lower end of the spinal cord: it was composed of vessels whose adventitia had become hyaline, and was beset with bulging hyaline outgrowths (Art. 163, Fig. 57).

**Fibroma** of the central nervous organs is rare: it forms rounded nodes, which in the cord and roots of the spinal nerves are sometimes multiple, especially in cases of multiple fibromata (neurofibroma) of the peripheral nerves (Arts. 154, 399, 670).

BIDDER mentions a case of **osteoma** in the corpus striatum; it measured several centimetres in diameter. MESCHÉDE met with a bony

growth in the cerebral hemisphere of an epileptic. BENJAMIN describes a **lipoma** in the cerebrum.

**Secondary growths**, sarcomatous and carcinomatous, occur in the brain as in other organs: they usually form rounded nodes or nodules.

KLEBS maintains (*Viertelj. f. prakt. Heilk.* 125, 133) that the ganglion-cells take an active part in the production of gliomatous neoplastic cells, and HELLER (*Naturforscherversammlung in Freiburg* 1883) agrees with him. The author has gone over again his preparations of glioma, but is unable to find any ground for altering the view expressed in Art. 145. The ganglion-cells do indeed swell up considerably, and occasionally a binuclear cell can be seen; but that is all. As the tumor develops the ganglion-cells break down, and the clusters of neuroglia-cells afterwards found in their place are evidences merely that the latter have multiplied in their neighborhood.

As we remarked in Art. 651 it is not possible to draw a sharp line between glioma and sclerosis. This is especially true of the gliomatous growths occurring round the central canal of the cord, but it also holds of cerebral glioma. Sometimes part of the neoplastic change will appear to be essentially due to increase and induration of the connective tissue, while close by there is an unmistakable sharply-defined tumor.

Probably the smallest sarcomata of the central nervous organ hitherto described were observed some time ago by the author and Dr. ANDREAE in the cord of a lady who had suffered from some ill-defined disturbance of the innervation of the left arm: two nodules of spindle-celled sarcomata 2 and 3 mm. in diameter respectively were found in the left anterior horn of the cervical cord. The author has met with numerous small fibromatous nodules in the nerve-roots and the cord of a patient suffering from multiple fibroma of the peripheral nerves.

References:—VIRCHOW, *Krankhafte Geschwülste*; SCHÜPPEL, *Arch. d. Heilk.* VIII. 1867 (glioma and gliomyxoma of the cord); K. HOFFMANN, *Zeitschr. f. rat. Med.* XXXIV. 1869 (glioma); NEUMANN, *Virch. Arch.* vol. 61; TH. SIMON, *ibid.* vol. 61; GOLGI, *Cent. f. med. Wiss.* 1875; KLEBS, *loc. cit.*; GANGUILLET, *Beitr. z. Kenntniss d. Rückenmarkstumoren* Berne 1878; PETRINA, *Prager Viertelj.* 133, 134; ROTH, *Arch. de physiol.* 1878 (diffuse glioma of the cord); MESCHÉDE, *Virch. Arch.* vol. 35; BIDDER, *ibid.* vol. 88; LEBERT, *Traité d'anat. path.* II.; CORNIL and RANVIER, *Man. Path. Hist.* I. London 1882; BENJAMIN, *Virch. Arch.* vol. 14 (lipoma of cerebrum); SCHULTZE, *Arch. f. Psych.* VIII. (periependymal angiomatous gliosarcoma of the cord); MEYER and BAYER, *Arch. f. Psych.* XII (relation of encephalitis to glioma); GERHARDT, *Festschrift d. Universität Würzburg* 1882 (glioma); OSLER, *Journ. of Anat. and Physiol.* xv. 1881 ('neuroma' of the brain, rather a heterotopia); REISINGER, *Virch. Arch.* vol. 98 (glioma of the cord); GLASER, *Arch. f. Psych.* XVI. (angiosarcoma of the cord); RENAULT, *Gaz. méd. de Paris* 1884 (cerebral glioma); BAIRD, *Les tumeurs du type nerveux*, *Arch. de physiol.* v. 1885.

663. The **tumors of the internal meninges**, the telæ choroidæ, and the lining membrane of the ventricles are chiefly of the mesoblastic or connective-tissue type; but epithelial or carcinomatous growths are also met with.

In the first place we have a group belonging to the **sarcomata** which form soft nodes, or less frequently broad flattened growths. Their section is marrowy, grayish-white or grayish-red in tint, sometimes almost

gelatinous. They are commonest about the base of the brain, more rare on its convexity, still rarer in the pia mater of the cord and telæ choroideæ of the ventricles; they are either entirely confined to the meninges or encroach somewhat on the nerve-substance.

So far as investigations have shown they originate partly in the adventitia of the vessels and partly from the (endothelial) cells which cover the fibrous trabeculæ of the arachnoid, subarachnoid, and pia mater. The new-formed cells become highly developed, and resemble the multiform epithelial cells of carcinoma. As they lie in a stroma composed of the meningeal tissues and form dense clusters in its meshes which look exactly like nests of cancer-cells, the tumor has the appearance of a carcinoma and is often so described. It is however strictly speaking an **alveolar sarcoma** (nested sarcoma) in type, and its structure and the grouping of its endothelial cells justify us in classing it with the endotheliomata (Art. 161).

**Endothelioma** appears to be the commonest growth met with in the soft membranes, but others also occur from time to time which must be classed as ordinary **sarcoma**, **myxosarcoma**, and **myxoma**; the latter is chiefly found in the pia mater of the cord.

The blood-vessels of sarcomatous and myxomatous growths sometimes develop in number and size until they transform these into what we must call **angiosarcoma**, **angiomyxoma**, and **angiomyxosarcoma**. The vessels are wide and thin-walled or narrow and thick-walled, and form networks and complicated coils. The intervacular tissue may be simply fibrous; or mucous, or sarcomatous. If it is scanty the tumor assumes the aspect of a simple **angioma**.

Fibroma, lipoma, and chondroma are rare; but they do occur in the meninges and ventricular plexuses, forming small nodular or lobulated tumors which compress the nervous tissue. Seated at the lower end of the cord they sometimes encircle and compress the nerves of the cauda equina, and lead to their atrophy and degeneration.

Another rare growth in the pia mater consists essentially of a coarse fibrous stroma containing wide cysts or cavities filled with lymph. It looks somewhat like a piece of cedematous tissue, but is distinguished therefrom by the abundant development in it of fibrous tissue, which marks it off sharply from the surrounding structure and forms thick septa between the cysts. It is thus a true neoplasm and might be described as cystic lymphangioma or **cystic fibroma**.

In all these growths, but especially in myxoma and in fibroma, calcification may set in, and alter the vessels or lead to an increase of the so-called **brain-sand**.

Calcareous plates are often formed in the otherwise unaltered pia mater; and in the ventricular plexuses the brain-sand may be so increased that the plexuses are visibly enlarged and turn an opaque white.

In tumors the like occurs, in combination with calcareous degenera-

tion of the vessels. When the accumulation of calcareous matter in the growth is very great we have what is called **psammoma**. The organic basis of brain-sand consists of flattened cells which cohere like the coats of an onion, become homogeneous and lose their nuclei, and then are calcified.

**Carcinomata** are found in the ventricles, and form soft tumors (Fig. 282 *a*), usually connected with the plexuses and originating in their epithelium or (more rarely) in that of the ependyma. The cancer-cells (Fig. 283 *a*) lying in a fibrous stroma are of the cylindrical or columnar type. By the outgrowth of the vascular stroma into papillæ the tumor sometimes assumes a papillomatous appearance (Fig. 283).

If as not infrequently happens the stroma undergoes partial mucoid degeneration (Fig. 283 *b c c*;) the tumor exhibits a very peculiar struc-

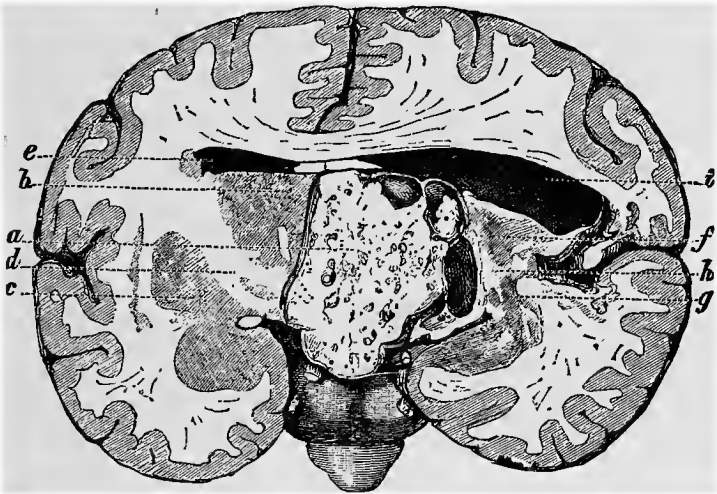


FIG. 282. PAPILLOMATOUS CARCINOMA OF THE CHOROID PLEXUS.

(Frontal section through the third ventricle.)

*a*, tumor with cysts  
*b*, right optic thalamus  
*c*, right lenticular nucleus  
*d*, right internal capsule  
*e*, right corpus striatum

*f*, left optic thalamus  
*g*, left lenticular nucleus  
*h*, left internal capsule  
*i*, dilated left lateral ventricle

ture. The papillary outgrowths are transformed into cysts (Fig. 282, Fig. 283 *d*) separated merely by strings of epithelial cells (*e*), so that the epithelium forms a kind of stroma enclosing cysts formed of connective-tissue. **Epithelial pearls**, or concentric globes (*h*), are sometimes formed in the midst of the masses of epithelium, and look wonderfully like those met with in cutaneous cancers (Art. 172), while contrasting sharply with the cylindrical cells of the growth.

The tumor is usually confined to the ventricle, and leads to compression of the brain-substance (Fig. 282 *f g h*) and ventricular dropsy (*i*).

It may however invade the brain-substance, and give rise to secondary nodules (SPAET). It is not certain whether this form of tumor occurs as a primary growth in any other region, but it is quite possible that it may arise say about the anterior or posterior transverse fissure, or at the base of the brain near the infundibulum; it probably develops from aberrant germinal epithelium (Art. 181).

**Cholesteatoma**, or pearly tumor, is one whose mode of origin is not well understood; it is a growth characterized by the presence in it of white rounded 'pearls' with a nacreous lustre. It occurs chiefly in the dura mater of the base of the brain about the transverse fissures, but it is also found in the interior of the organ. The soft white mass of the growth consists mainly of epithelial scales like those of the epidermis. Most authorities assume its endothelial origin; but it seems more likely

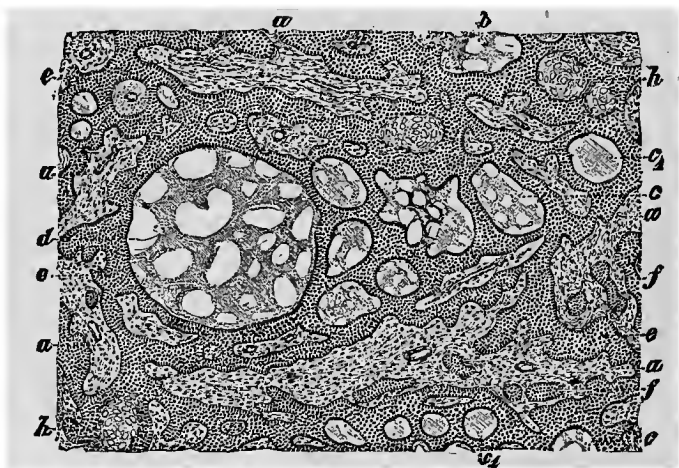


FIG. 288. PAPILLOMATOUS CARCINOMA WITH GELATINOUS DEGENERATION OF THE STROMA FROM THE THIRD VENTRICLE.

(Section hardened in Müller's fluid, stained with alum-carmine:  $\times 25$ .)

- |   |  |
|---|--|
| a, fibrous stroma with blood-vessels                | d, cyst in degenerate stroma, with coagulated contents |
| b, partially mucoid papilla                         | e f, interpapillary strings and nests of cells         |
| c, mucoid papilla coagulated by the hardening fluid | h, epithelial pearls                                   |
| c <sub>1</sub> , hyaline masses                     |  |

that its 'pearls' are derived from the epidermic epithelium of the medullary tube, and are thus connected by descent with the external surface. Moreover in rare cases (ZIEGLER) minute hairs have been found in the mass; and the situation of the tumor points in the same direction, for the places described are such that at the time of the development of the brain primitive epiblastic cells might well remain unelaborated, and form the rudiment of a neoplasm at a later stage (Art. 181).

**Secondary growths** of every kind occur in the meninges. It is worth noting that they sometimes spread far and wide in the subarachnoid spaces. Thus a metastatic cancer of the pia mater in the vertebral canal may in course of time encircle the greater part of the cord and infiltrate the cauda equina.

Of **animal parasites** the *Echinococcus* and *Cysticercus* are found in the brain and cord. The former takes the form of single or multiple hydatid vesicles of various size, which compress the nerve-substance and lead to softening. The *Cysticercus*, or measles, is commonest in the meninges of the brain, and appears either in the usual form as a small cyst with its scolex, or as the *Cysticercus racemosus*, a cluster of large lobulated usually sterile vesicles grouped like grapes around a parent cyst (Arts. 243, 245).

We may here make mention of some formations which are not strictly tumors, though in some points resembling them.

**Aneurysms** of the basilar arteries are very common, and reach a considerable size (see LEBERT, *Berl. klin. Woch.* 1866). **Varices** are developed chiefly in the pial veins of the cord, and sometimes become so large that they form vascular knots like hæmorrhoids, which compress the cord and lead to its degeneration. In the cerebral ventricles are found small nodules seated on the ependyma: they are simply compact **fibrinous deposits** which have become partially organized and contain formative cells and capillaries.

Many of the growths described as cerebral cancer or epithelioma have no claim to the title. EBERTH'S and ARNDT'S epitheliomata of the pia mater were cases of alveolar sarcoma; only those alveolar neoplasms in the development of which the epithelium of the medullary tube is concerned are to be reckoned as carcinomata.

CORNIL and RANVIER state (*Man. Path. Hist.* I. London 1882) that brain-sand arises from buds or off-shoots from the vessels, which are made up of flattened cells and presently become calcareous. They therefore describe the tumors which are characterized by the abundant presence of the sand as **angiolithic sarcomata**. It is doubtful whether all brain-sand is of this kind.

References on tumors:—VIRCHOW, *loc. cit.*; MÜLLER, *Virch. Arch.* vol. 8 (cholesteatoma), vol. 16 (melanoma); ROKITANSKY, *Handb. d. path. Anat.* II. (cholesteatoma, angioma); LEBERT, *Maladies cancéreuses* Paris 1851; PARROT, *Arch. de physiol.* 1869 (lipoma); MORRIS, *Trans. Path. Soc.* XXII. (angioma); WILKS and MOXON, *Path. Anat.* London 1875 (chondroma); ROBIN, *Journ. de l'anat. et de la physiol.* 1869 (endothelioma); J. ARNOLD, *Virch. Arch.* vol. 51 (cystic sarcoma telangiectodes); EBERTH, *ibid.* vol. 49 (endothelioma); ARNDT, *ibid.* vol. 51 (endothelioma); MESCHÉDE, *ibid.* vol. 35 (osteoma); KLEBS, *loc. cit.*; EPPINGER, *Prager Viertelj.* 1875 (cholesteatoma); SPAET, *Primärer multipler Epithelkrebs d. Gehirns* Munich 1882; RINDFLEISCH, *Path. Hist.* II. London 1873; BERNHARDT, *Beitr. z. Symptom. u. Diagnost. d. Hirngeschwülste* Berlin 1881; GANGULLET, *loc. cit.* (sarcoma of spinal pia mater); LEYDEN, *Klinik d. Rückenmarkskr.*; ERB, *Ziemssen's Cyclopædia* XIII.; FALKSON, *Virch. Arch.* vol. 75 (chondrocystosarcoma of choroid plexus); LACHMANN, *Arch. f. Psych.* XIII. (glioma of the filum terminale); DRESCHFELD, *Journ. of Anat. and Physiol.* XIV. 1879 (psammoma); BILLROTH, *Arch. d. Heilk.* III. (myxoma of pia mater of cerebellum); CHIARI, *Prag. med. Woch.* 1883 (cholesteatoma of dorsal cord); LANCEREAUX, *Traité d'anat. path.* II.

On *Cysticercus racemosus*:—VIRCHOW, *Virch. Arch.* vol. 18; HELLER, *Ziesssen's Cyclopædia* III.; MARCHAND, *Virch. Arch.* vol. 75, *Breslau. ärztl. Zeitschr.* 1881; ZENKER, *Ueb. d. Cyst. racem. d. Gehirnes* Erlangen 1882, *Henle's Beiträge* Bonn 1882; GRIESINGER, *Arch. d. Heilk.* III. 1862 (with references); FERBER, *ibid.*

On hydatids of the brain see the works of COBBOLD, DAVAINÉ, etc. (Arts. 245-248).

## CHAPTER XXVIII.

### THE DURA MATER, PINEAL BODY, AND PITUITARY BODY.

664. The **dura mater** is a stout fibrous membrane, closely adherent to the inner surface of the cranium, and dividing into two laminæ at the foramen magnum: one of these lines the vertebral canal, the other forms a sack-like investment for the spinal cord, the intervening space containing loose connective tissue, fat, and blood-vessels, in particular the venous plexuses.

Where the dura mater adheres to the bone it serves as its periosteum, and is liable to all the morbid changes that affect the periosteum of other bones. Certain special dangers also arise from its connection with the central nervous system, and these require separate consideration.

In the first place the dura mater is very frequently the seat of an inflammatory process known as **chronic internal pachymeningitis**, the result of various injurious agencies whose exact nature is not fully understood. The inflammation is usually hæmatogenous, and is associated either with inflammation of the pia mater and subarachnoid tissue on the one hand or with disease of the bones on the other. It is commonest in the cerebral dura mater, and may be unilateral and circumscribed, or bilateral and in scattered areas or generally diffused.

The first morbid sign is the appearance of very thin fibrinous deposits on the internal surface of the membrane: these consist of scanty liquid and cellular exudations from the dural vessels. After a time the fibrin becomes organized, or in other words pervaded by living cells and new-formed vessels growing as off-shoots from the inflamed capillaries. A delicate fibrous tissue is thus elaborated, which lines the dura mater as a semi-transparent vascular membrane.

The new-formed vessels have very thin walls and are particularly prone to bleed, the slightest disturbances of the circulation apparently sufficing to set up **hæmorrhage** by rupture or diapedesis. The consequence is that pachymeningitic membranes nearly always contain recent extravasations and pigmented deposits testifying to past hæmorrhage; this peculiarity has led to the affection being described as **hæmorrhagic pachymeningitis**. The extravasations are usually small, but now and then they are so extensive that they separate the false membrane from the dura, and form blood-cysts or **hæmatomata**, which may cause

grave compression of the brain. If the cyst gives way blood will of course escape into the subdural spaces.

Once the inflammation has begun it seldom attains to complete resolution and recovery. The extravasated matters are by degrees reabsorbed, but if they are at all abundant the process is very slow and imperfect, and their continued presence keeps up an irritation that induces renewed inflammation. New exudations and new membranes are thus produced, and at length a dense scar-like tissue results, which contains masses of pigment, fibrinous residues, and calcareous matters. Sometimes after resorption of a hæmorrhagic extravasation a localized collection of liquid appears between the dura and the cicatrized membrane; this has been called **hygroma of the dura mater**, or partial pachymeningitic hydrocephalus. In older denser and more fibrous membranes some of the vessels are gradually occluded by contraction, but other parts remain highly vascular, and fresh hæmorrhages keep up the chronic inflammation.

Pachymeningitic membranes do not usually adhere to the arachnoid; but when this happens the new-formed vessels pass down into the internal meninges.

There is also an **external chronic pachymeningitis** in which the changes are chiefly limited to the cranial surface of the dura mater: they consist of thickening of the membrane and absorption or hyperplasia of the bone. Moreover, the dura mater is frequently inflamed by extension of mischief from contiguous parts. Thus suppuration due to an infected wound of the skull may involve the dura mater (Art. 654); and otitis media or inflammation of the petrous bone or of the vertebræ or the interdural tissue frequently extends to this membrane. When suppuration takes place the dura has a discolored yellowish-white or grayish-yellow appearance: if the suppuration is preceded by hæmorrhage the tint may be grayish-green or brown.

**Tuberculosis** arises as a concomitant of embolic tuberculous leptomeningitis or of tuberculous bone-disease. The inner surface of the dura is beset with disseminated gray tubercles, while in more advanced stages pachymeningitic membranes containing tubercles, or large granulomatous vegetations, or caseous foci are found. The latter are commonest in connection with bone-disease, and then frequently affect both surfaces of the membrane.

In **syphilis** cellular infiltrations and granulations are formed in the dura mater, and lead in time to dense scar-like thickenings, which frequently enclose caseous masses. If the process goes on extensive adhesions are set up with the arachnoid and pia mater.

Most **tumors** of the dura mater are sarcomatous. The spindle-celled forms are the most frequent, but round-celled and multiform-celled types are also found. We also meet with **alveolar sarcomata** and **endotheliomata**, characterized by the formation of cell-nests and re-

ticulated strings of cells (Fig. 284 *cd*) within a fibrous stroma (*a*). These latter take the form of flattened or pedunculated fungoid outgrowths (*fungus duræ matris*), varying from the size of a pea to that of an apple, which grow inwards and indent the surface of the brain or cord. On the outer aspect of the dura they erode and even perforate the bone by continuous pressure and consequent atrophy. They are commonest within the cranium, being indeed rare in the spinal canal. The pedicle sends out root-like processes of cells into the substance of the dura mater, from which the growth evidently originates. The endothelium of the lymphatic vessels furnishes the characteristic clusters and strings of cells, and the latter are often excavated (*d*) in a way that immediately suggests the parent vessel. This appearance is visible chiefly in the recent parts of the growth, the older parts showing merely

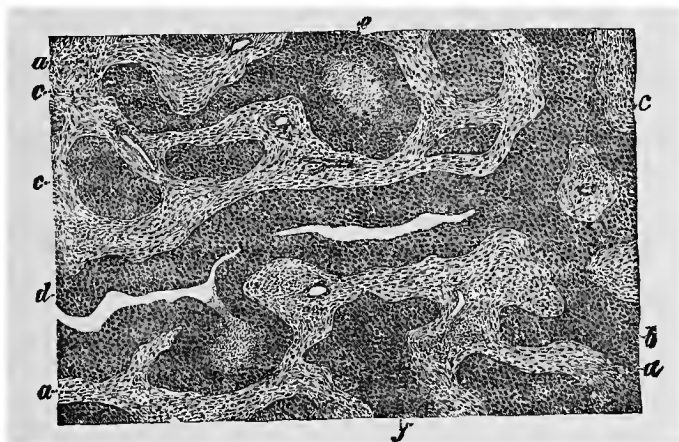


FIG. 284. ENDOTHELIOMA OF THE DURA MATER.

(Hardened in Müller's fluid, stained with hæmatoxylin, and mounted in Canada balsam :  $\times 25$ .)

- |   |   |
|---|---|
| a, fibrous stroma   | d, tubular tract of endothelial cells   |
| b, group of round-cells   | e, fatty degeneration of a cellular mass  |
| c, nests and strings of cells derived from the endothelium of the lymphatic vessels | f, mass of endothelial cells, on the right side passing gradually into the fibrous stroma |

a diffuse cell-growth which passes gradually into the structure of the fibrous tissue. When tumors of the dura mater become very vascular they may assume some of the characters of **angioma**; if the vessels calcify and give rise to an abundant production of brain-sand the growth becomes a **psammoma**.

**Fibroma** is on the whole rare, but it may occur in any part of the dura mater, forming rounded tumors; **lipoma** is very rare.

**Enchondroma** is not infrequently met with in the form of small gelatinous nodules about the back of the sella turcica and basilar portion of the occipital bone; the tumor originates in residual unossified frag-

ments of the cartilaginous synchondrosis between this bone and the sphenoid.

**Osteoma** occurs chiefly in the cerebral dura mater, and most frequently about the falx cerebri. The growth appears as a plate of bone of irregular form with spinous and ridge-like processes.

Of secondary or **metastatic growths** in the dura mater carcinoma is the most usual.

References on pachymeningitis:—VIRCHOW, *Würzburg. Verhandl.* 1856; SCHUBERG, *Virch. Arch.* vol. 16; KREMIANSKY, *ibid.* vol. 42; WEBER, *Arch. d. Heilk.* I. 1860 (hæmatoma); LANCEREAUX, *Arch. générales de méd.* 1862-63, *Traité d'anat. path.* II.; WILKS, *Med. Times and Gaz.* 1, 1868; RINDFLEISCH, *Path. Hist.* II. London 1873; SPERLING, *Cent. f. med. Wiss.* 29, 1871; PAULUS, *Verkalkung und Verknöcherung d. Hämatomes d. Dura Mater* Erlangen 1875; HUGUENIN, *Ziemesen's Cyclop.* XII.

On tumors of the dura mater:—ROKITANSKY, *Lehrb. d. path. Anat.* II.; ROBIN, *Recherches anat. sur l'épithéliome des séreuses*, *Journ. de l'anat.* 1869; LEBERT, *Virch. Arch.* vol. 3; ARNOLD, *ibid.* vol. 52; RUSTIZKY, *ibid.* vol. 52; BIZZOZERO and BOZZOLO, *Wiener med. Jahrb.* 1874; SCHÜPPEL, *Arch. d. Heilk.* X. (1869); VIRCHOW, *Die Entwicklung d. Schädelgrundes* 1857 (ecchondrosis of the basi-occipital); LUSCHKA, *Virch. Arch.* vol. 11 (ditto); ZENKER, *ibid.* vol. 12 (ditto); LANCEREAUX, *Traité d'anat. path.* II.

665. The hypophysis cerebri or **pituitary body** is seated in the sella turcica, and is composed of two lobes: the anterior consists of a fibrous stroma enclosing numerous round and oval follicles filled with epithelial cells, the posterior of vascular connective tissue containing cell-like clusters of fat-granules. At the junction of the two lobes the tissue is very vascular, and contains cavities lined with ciliated columnar epithelium (WEICHELBAUM).

Cystic degeneration and hyperplastic overgrowth of the anterior lobe are not uncommon, the cysts usually containing colloid masses. This transformation is called **adenoma** of the pituitary body (WEIGERT), and the growth sometimes reaches the size of a hen's egg. It of course protrudes more or less from the sella turcica, presses on the adjoining brain-substance, or into the ventricles (ZENKER), and sometimes leads to atrophy of the underlying bone.

According to WEICHELBAUM the ciliated cavities are very apt to undergo cystic change, the cysts containing homogeneous or granular matter secreted by the epithelium.

After adenoma the commonest growths are **carcinoma** and **sarcoma** (KLEBS), which also take the form of nodose swellings. WEICHELBAUM has described a pair of small lipomata in the posterior lobe, and WEIGERT a teratoma.

The pituitary body may be inflamed in connection with disease of the neighboring parts: tubercles and gummata are however rare in this situation (WEIGERT).

The **pineal body** consists of fibrous tissue enclosing a number of more or less spherical follicles, each containing a reticulate structure of epithelial cells, a number of rounded cells with slender processes (TOLDT), and a quantity of brain-sand.

The most frequent pathological changes observed in this organ are—abnormal increase of the quantity of brain-sand (psammoma), hyperplastic enlargement (so-called glioma), and cystic degeneration (hydrops cysticus); it may participate in inflammations of the adjacent structures. The author once found in it a tumor as large as a pigeon's egg, consisting essentially of blood-clot (hæmatoma).

References on the pituitary body: VIRCHOW, *Die krankhaften Geschwülste*; ZENKER, *Virch. Arch.* vol. 13; WAGNER, *Arch. d. Heilk.* 1862; WEIGERT, *Virch. Arch.* vol. 65; WEICHSELBAUM, *ibid.* vol. 75; RIBBERT, *ibid.* vol. 90; KLEBS, *Viertelj. f. prakt. Heilk.* 125; BECK, *Zeitschr. f. Heilk.* IV. 1883 (teratoma); BERNHARDT, *Beiträge z. Sympt. u. Diagnostik d. Hirngeschwülste* Berlin 1881.



SECTION XII.  
PERIPHERAL NERVOUS SYSTEM.



## CHAPTER XCIX.

### STRUCTURE OF PERIPHERAL NERVES.

666. The peripheral nervous system is composed of **nerves** and **ganglia**, together with certain **terminal organs**. The nerves consist essentially of medullated and non-medullated fibres: in the ganglia there are similar nerve-fibres and associated ganglion-cells.

A **medullated fibre** is a long cylindrical structure, the axis being occupied by the so-called **axis-cylinder**. During life the latter is homogeneous and enclosed in a sheath of myeline (**medullary sheath**), and this again in a delicate fibrous envelope—the primitive sheath, neurilemma, or **sheath of Schwann**. The medullary sheath is interrupted at intervals by the **nodes of Ranvier**: at these points the axis-cylinder is covered only by the sheath of Schwann, and chiefly through them is its nutrition kept up. Each nerve-fibre is thus subdivided into segments of 1 to 2 mm. in length; each segment has about its middle a nucleus lying close to the sheath of Schwann, and on the inner side of the sheath close to the nucleus is a thin layer of protoplasm. External to the sheath of Schwann is a fibrillar sheath (AXEL KEY and RETZIUS), which also contains nuclei and a scanty protoplasm.

The **non-medullated fibres** possess an axis-cylinder with a primitive sheath containing nuclei at intervals.

Both kinds of fibres unite to form nerves of various degrees of thickness: the nerves from the brain and cord consist chiefly of medullated fibres, those of the sympathetic system chiefly of non-medullated fibres.

The smaller nerves consist of a single bundle of nerve fibres, the larger nerves of a certain number of bundles.

Each bundle (Figs. 286, 288 *c*) is surrounded by a fibrous envelope or **perineurium**: in a large trunk several such bundles are enclosed in a perineurium (Fig. 288 *a*), each of them being surrounded by an **epineurium** (*b*) of loose connective tissue, often containing fat-cells. Septa pass from the perineurium between the bundles (Fig. 286), and subdividing into finer fibres surround the individual nerve-fibres with an **endoneurium**. The blood-vessels of the nerve-trunk run in these fibrous envelopes. At the peripheral ends the axis-cylinders break up into primitive fibrils, and these terminate in the various peripheral end-organs.

In the course of some of the nerves (especially of the sympathetic)

are one or more clustered groups of ganglion-cells: when these are large enough to be easily visible they are called **ganglia**. The cells and fibres of such a ganglion lie in a fibrous stroma whose elements are in direct continuity with the fibrous structures of the corresponding nerve.

The **morbid changes** occurring in the nerves affect partly the nervous elements, partly the fibrous framework. In many respects the changes correspond to those affecting the central nervous system, but they also offer remarkable peculiarities of their own.

## CHAPTER C.

### ATROPHY AND DEGENERATION.

667. The degenerative processes which lead to **atrophy** and disappearance of the peripheral nerve-fibres and ganglion-cells correspond in their general course with the like processes in the brain and cord.

In the first place fibres and cells may gradually dwindle and waste away without undergoing any appreciable change of structure. More frequently however the destruction is speedier and accompanied with the various evidences of disintegration so often observed in the central organs.

In the **medullated fibres** there appears first a turbidity and then a splitting up of the medullary sheath, leading to the formation of large and then of smaller fragments and droplets of myeline, until the whole sheath is reduced to globules or particles. The axis-cylinder and its primitive fibrils may in like manner break up into small fragments (Fig. 285 *c*), or swell up and become liquefied; though it must be remembered that the axis shows itself more resistant towards many kinds of injury than the medullary sheath.

The sheath of Schwann usually remains intact, and even the so-called nerve-corpuscles or nuclei of the several segments persist also (Fig. 285 *d d<sub>1</sub> d<sub>2</sub>*). When the medullary sheaths break up, extravasated leucocytes pick up the products of disintegration and form fat-granule cells which lie within the primitive sheaths or in the fibrous envelopes. Sometimes the cells of the connective tissue also become fatty.

The single or clustered ganglion-cells occurring in the course of the nerves perish by swelling and liquefaction, by fatty change, or by simple atrophy.

A medullated nerve which has lost its medullary sheath shrinks in volume and looks gray and translucent: if it is at the same time vascular its tint is grayish-red.

The exact manner and extent of the degeneration of the nerve-elements depends on the nature of the injurious or destructive agent which is at work; though in all degenerative processes there is one feature which is constant, namely the prompt extension of the change over all the portion of the nerve to the distal side of any point at which the axis-cylinder is completely interrupted.

Such an interruption is most quickly and most completely effected by **section of the nerve**, and thus in the investigation of peripheral degeneration such intentional or unintentional section plays the chief part. At the cut surfaces of a nerve there quickly appears a button-like protrusion and swelling of a gray or grayish-red tint, together with some gelatinous exudation. In a day or two the segments of the peripheral portion become less refractive, and turbid, and by the third day the medullary and primitive sheaths are deeply indented at the nodes. On the fourth to the sixth day the medulla breaks up into large drops of myeline, and in a few days more there is nothing of it left but droplets and granules of detritus which are ultimately absorbed.

The axis-cylinder speedily becomes almost or altogether invisible, and perishes partly by swelling and vacuolation, partly by breaking up into fragments.

In simple uncomplicated section of the nerve the proximal or central end degenerates for a small distance only from the wound, the change stopping at the first or second node of Ranvier. Only when the nerve-end is bruised or otherwise inflamed do some of the bundles degenerate for a greater distance. In such a case the primitive sheath of the degenerate fibres contains a large number of extravasated leucocytes which in simple section are seldom or never very abundant.

Severe crushing or pinching and abiding compression (as from a tumor or a shrinking cicatrix) of a nerve have an effect similar to section, the latter leading to anæmic necrosis or degeneration of the compressed portion. The difference is chiefly in the fact that the interruption is not at once complete, but affects the several strands or bundles in succession.

**Disease of the anterior horns** of the cord and of the motor roots leading to destruction of motor ganglion-cells or nerve-fibres are, like other interruptions of the conducting tracts, followed by peripheral degeneration: but it must be kept in mind that when the destruction of the ganglion-cells is more gradual the corresponding atrophy of fibres is not so rapid, the medullary sheath wastes by degrees (Fig. 285 *b*), and within one and the same bundle we may find fibres that are sound, others partially atrophied (*b c*), and others totally destroyed (*d<sub>1</sub> d<sub>2</sub>*).

A second frequent cause of degeneration of the nerves is primary and secondary **neuritis**, due to traumatic or infective inflammation of the connective-tissue framework (Art. 669), which leads to disturbance of the circulation and nutrition of the nerve or to direct compression of it. Sometimes too hæmorrhages give rise to injurious pressure on the nerve-fibres.

Lastly, motor nerves atrophy when their **muscles** are long **disused** (FISCHER), the atrophy being however confined to the peripheral parts: there is no ascending atrophy of such nerves to any extent comparable with the descending atrophy.

Occasionally we meet with local or multiple peripheral degenerations of which we cannot with certainty discover the cause. Thus the **vagus** is subject to degenerative changes without any apparent compression, inflammation, or other injury. BLASCHKO describes a wide-spread fatty degeneration of Auerbach's and Meissner's plexuses in the intestines. The **multiple neuritis** of some authors (Art. 669) is in fact of the nature of degenerative atrophy.

In such isolated degenerations we must assume that some disorder of the circulation (due *e. g.* to change in the vessels or change in the blood) is at work. Thus **lead-poisoning** gives rise not only to degeneration of the muscular nerves (LANCEREAUX, GOMBAULT, FRIEDLÄNDER, etc.) but also to change in the intestinal plexuses. When the nerve-changes are acute and accompanied by febrile disturbance it is probable that

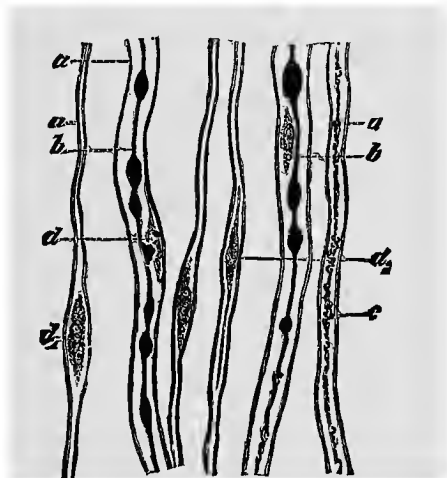


FIG. 285. ATROPHY OF MOTOR NERVES IN ANTERIOR POLIOMYELITIS.

(Treated with Müller's fluid and perosmic acid, and teased out in glycerine :  $\times 200$ .)

- |   |  |
|---|--|
| a, sheath of Schwann                            | d, uninuclear,   |
| b, axis-cylinder with adherent drops of myeline | d <sub>1</sub> , multinuclear,                             |
| c, axis-cylinder breaking up                    | d <sub>2</sub> , bipolar cell within the sheath of Schwann |

infection of some kind is in question. R. MAIER showed experimentally that in chronic lead-poisoning the submucous and myenteric ganglion-cells become turbid, lose their nuclei, break into fragments, and disappear, while the connective tissue about them is simultaneously increased.

According to KEY, RETZIUS, S. MAYER, and KORYBUTT-DASZKIEWICZ, degenerative and regenerative changes take place normally in peripheral nerves; and many filaments hitherto assigned to the fibrous sheaths or the fibres of Remak are simply degenerate or nascent nerve-fibres.

The drops of myeline in degenerate nerves are stained black by perosmic acid

while the granular matters are unstained: S. MAYER infers from this that the nerve-substance breaks up into fatty and albuminoid component elements.

As to the exact fate of the axis-cylinder of the peripheral end of a cut nerve there is still some uncertainty, notwithstanding the numerous investigations that have been made: there is no question as to the medullary sheath. WALLER, EULENBURG, LANDOIS, HJELT, RANVIER, BENECKE, COSSY and DÉJÉRINE, TIZZONI, LEEGARD, VANLAIR, FALKENHEIM, and others state that the axis-cylinder degenerates; SCHIFF, PHILIPPEAU, KORYBUT-DASZKIEWICZ, ERB, CHARCOT, WOLBERG, and others maintain that it persists intact. In the text we have adopted the former account. After loss of the ganglion-cells in the anterior horns of the cord the axis-cylinders of the motor fibres, and after section of a peripheral nerve those of all the fibres, degenerate.

References on degeneration and regeneration of nerves after section:—WALLER, *Müller's Arch.* 1852, *Comptes rendus* 1851-52; SCHIFF, *ibid.* 1854; PHILIPPEAU and VULPIAN, *ibid.* 1859; HJELT, *Virch. Arch.* vol. 19; REMAK, *ibid.* vol. 23; EINSIEDEL, *Ueb. Nervenregener. nach Ausschneidung eines Nervenstückes* Giessen 1864; LAVERAN, *Rech. exp. sur la régénér. d. nerfs* Strasburg 1867; EULENBURG and LANDOIS, *Berl. klin. Woch.* 1864-65; ROBIN, *Journ. d. l'anat.* 1868; NEUMANN, *Arch. d. Heilk.* ix. (1868); ERB, *D. Arch. f. klin. Med.* iv., v.; HERZ, *Virch. Arch.* vol. 46; VULPIAN, *Arch. d. physiol.* 1873-74; WEIR-MITCHELL, *Injuries of nerves* London 1872; LÉTIÉVANT, *Traité des sections nerveuses* Paris 1873; LEEGARD, *D. Arch. f. klin. Med.* xxvi.; BENECKE, *Virch. Arch.* vol. 55; RANVIER, *Leçons sur l'histologie du syst. nerv.* Paris 1878; COSSY and DÉJÉRINE, *Arch. de physiol.* 1875; ENGELMANN, *Pflüger's Arch.* xiii. (1876); BAKOWIECKI, *Arch. f. mikrosk. Anat.* xiii. (1876); COLOSANTI, *Arch. f. Anat. und Physiol.* 1878; GLUCK, *Virch. Arch.* vol. 72, *Arch. f. klin. Chir.* xxv., xxvi.; SANTI SIRENA, *Ricerce sperim. sulla reprod. d. nervi* Palermo 1880; TIZZONI, *Arch. p. l. sci. med.* iii. (1878), *Cent. f. med. Wiss.* 1878, *Sulla patol. d. tessuto nervoso* Turin 1878; S. MAYER, *Degen. und Regen. d. Nervenfasern* Prague, 1881; HOGGAN, *Trans. Path. Soc.* xxxi. (1880), *Journ. d. l'anat.* xviii. (1882); GESSLER, *D. Arch. f. klin. Med.* xxxiii. (motor-nerve changes after section), *Die motor. Endplatte u. ihre Bedeut. f. d. periphere Lähmung* Leipzig 1885; NEUMANN, *Arch. f. mikrosk. Anat.* xiii. (1880), xviii. (1885); VANLAIR, *Arch. de biol.* iii. (1882); EICHHORST, *Eulenb. Realencyclop. d. gesam. Heilkunde*, *Virch. Arch.* vol. 59; PEYERANI, *Biol. Centralb.* iii. (1883); FALKENHEIM, *Zur Lehre von d. Nerven-naht* In. Diss. Königsberg 1881; TILLMANNS, *Arch. f. klin. Chir.* xxvii.; BASCH, *ibid.*; WOLBERG, *Deut. Zeitschr. f. Chir.* xviii., xix. (1883); NICAISE, *Internat. encyclop. of surgery* iii. London 1883; P. BRUNS, *Mitth. a. d. chir. Klinik* ii. Tübingen 1884; CATTANI, *Arch. p. l. sci. med.* viii. 1885 (nerve-stretching); HAYEM and GILBERT, *Modification du syst. nerv. chez un amputé*, *Arch. de physiol.* iii. (1884).

The memoirs of VANLAIR, FALKENHEIM, TILLMANNS and WOLBERG include not only experimental researches of their own, but also summaries of published cases, and criticisms on previous methods of experiment: the subject of nerve-suture is also dealt with. WOLBERG'S paper is the most comprehensive on all points bearing on the main subject.

On nerve-degeneration from lead-poisoning and from undetermined causes:—LANCEREAUX, *Gaz. méd. de Paris* 1862, 1871; GOMBAULT, *Arch. de physiol.* v. (1873); DÉJÉRINE, *Gaz. méd. de Paris* 1879; ZENKER, *Zeitschr. f. klin. Med.* i. (1880); WESTPHAL, *Arch. f. Psych.* iv. (1873), vi. (1875); REMAK, *ibid.* vi. (1875); VULPIAN, *Mal. du syst. nerveux* Paris 1879; FRIEDLÄNDER, *Virch. Arch.* vol. 75; POPOW, *ibid.* vol. 93; R. MAIER, *ibid.* vol. 90; KUSSMAUL and MAIER, *D. Arch. f. klin. Med.* ix. (1872); EISENLOHR, *ibid.* xxvi.; BLASCHKO, *Virch. Arch.* vol. 94; DUMÉNIL, *Gaz. hebdom.* 1864; SCHULTZE, *Arch. f. Psych.* xiv.; MONAKOW, *ibid.*

X.; MORITZ, *Journ. of Anat. and Physiol.* 1880; BIRSDALL, *Amer. Journ. of neurology* 1882; NAUNYN, *Ziemssen's Cyclop.* XVII.

On atrophy from disuse:—FISCHER, *Deut. Zeitschr. f. Chir.* VIII. (1877); SIEGMUND MAYER, *Prag. med. Woch.* 1878.

## CHAPTER CI.

### REGENERATION OF NERVES.

668. **Union of severed nerves.** It has long been known that nerves which have been cut through, and whose function has been thereby completely abolished, are capable of repair, and in the course of weeks or months recover their conducting power. Recent surgery has utilized this fact, and seeks to bring about the speedier union and recovery of severed nerves by **suture** of their ends. Over fifty cases have already been published in which nerve-suture has resulted in more or less perfect restoration of function, and that not only when the wounds were recent but in some cases where suture did not take place till after the lapse of months or years from the time of injury.

The union and recovery of severed nerves has been often observed in animals as well as in men, and in recent years a large number of experiments have been made to throw light on the fact and on the histological process by which it is brought about. Unfortunately we do not yet fully understand all the steps of this process: opinions differ as to the fate of the peripheral end of a severed nerve (Art. 667), and it is therefore scarcely surprising that authorities are not agreed as to the details of **regeneration**. Hardly two of the multitude of writers on the subject take exactly the same view, and we are therefore unable to give an account of it which shall be wholly satisfactory.

When the functional continuity of a nerve is interrupted by section, crushing, compression, etc. various things may happen. The nerve-fibres only may be injured, the nerve remaining still macroscopically continuous; or it may be completely severed, the ends retracting some small distance apart, or becoming so widely separated that there is no possibility of their reuniting naturally. The regenerative process can be best followed in the second case, which is that most frequently observed experimentally, the parted nerve-ends being reunited by the intercalation of a new-formed piece of nerve.

The wound that severs a nerve is immediately followed by an inflammation, which leads to swelling of the cut ends, and the deposit of exudation between them. In the subsequent week or two granulations and cicatricial tissue are formed, while the central and peripheral ends undergo the changes referred to in Art. 667.

The regeneration of the nerve-fibres begins a few days after the

operation (RANVIER) in the central end: RANVIER says at the very extremity of this end, VANLAIR at a distance of 1.5 to 2 cm. from it. EICHHORST observed the beginning of regeneration in the nerve of a rabbit on the fourteenth day after injury.

The first change is a swelling of some of the axis-cylinders in the outer parts (VANLAIR) of the nerve-bundles of the central end, and this is followed by subdivision of each into from two to five new axis-cylinders (RANVIER). The new cylinders grow in length, and form within the old sheath of Schwann whole bundles of new nerve-fibres (Fig. 286 *e*), which usually distend the lumen of the sheath and compress any persisting remnants of the older fibres (*f*). According to VANLAIR they sometimes burst the old sheath, and then either grow out amid the tissue

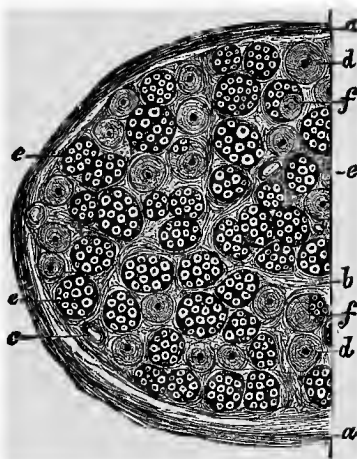


FIG. 286. CENTRAL END OF A NERVE-BUNDLE IN PROCESS OF REGENERATION.

(From the median nerve 4 months after severance by a stab; hardened in Müller's fluid, stained with neutral carmine, and mounted in Canada balsam:  $\times 200$ .)

- |                              |   |
|------------------------------|---|
| a, perineurium               | e, bundle of new-formed nerve-fibres          |
| b, endoneurium               | f, new-formed nerve-fibres compressing an old |
| c, blood-vessel              | fibre within the same sheath                  |
| d, old unaltered nerve-fibre |   |

of the endoneurium, or penetrate the perineurium of the bundles into the epineurium.

In this way at the extremity of the central end a large number of new fibres are developed. They consist at first of new-formed axis-cylinders surrounded by a protoplasmic nucleated sheath (VANLAIR), and presently they receive a homogeneous envelope of connective-tissue (*e*) formed at the expense of the protoplasmic sheath, and a thin medullary sheath which grows between the latter and the axis-cylinder. The perineurium of the bundles giving way and the new fibres thus dispersing as it were in the epineurium, the characteristic grouping of the nerve-fibres in

bundles is lost; the new fibres are more uniformly spread through the connective tissue, and the usually fatty epineural envelope assumes a striated fibrous appearance.

In this manner the re-formed and growing nerve enters the soft mass of granulations and cicatricial tissue that intervenes between the severed ends. When it reaches the peripheral end, some of whose fibres have meanwhile perished, certain of the new fibres enter the empty primitive sheaths (RANVIER), but the greater number penetrate the epineurium (VANLAIR) and perineurium and advance towards the peripheral end-organs. Others miss the peripheral end and run either alongside it or on a course of their own to the surface: many fibres too which leave the old track disappear and are lost in the tissues (VANLAIR). In the peripheral half of the intercalated cicatrix the nerve-fibres begin to gather once more into bundles (VANLAIR), and a perineurium forming round these, the whole thickness of the nerve by degrees assumes a nearly normal appearance.

These changes require weeks or months to complete: according to EICHHORST the fibres of the central end reach the cicatrix about the end of the first month, and in some three months the reunion is established.

It appears from the foregoing that the peripheral end does not itself regenerate, but is provided with nerve-fibres from the central end. VANLAIR describes the process as **neurotization**. It probably takes place in all cases of regeneration after severance, both when the nerve is actually cut through and when only the nerve-fibres and not the fibrous structures are interrupted. The difference is that in the former case the new fibres must grow through a certain amount of cicatricial tissue, while in the latter there is little or no granulation, and the axis-cylinders as they lengthen can directly enter the old fibres. Some authorities (GLUCK, WOLBERG, LANGENFELDT) state definitely that under favorable conditions very rapid union of the severed ends is possible, the function of the nerve being recovered in a very few days.

Even when the peripheral is so remote from the central end that direct union by nerve-tissue is out of the question, some attempt is still made at regeneration. The central end grows out (Fig. 286), but the axis-cylinders do not reach the peripheral end, and lose themselves in the cicatrix.

The so-called **amputational neuromata** (Art. 154) are of this nature; they are club-shaped enlargements of the severed nerve-ends occasionally met with in stumps which have healed after amputation. As they contain new nerve-fibres as well as connective-tissue they are doubtless due to an abortive attempt at regeneration in the nerve-stumps: when they include sensory fibres which are compressed or irritated by the cicatrix they are the source of very considerable pain. Similar traumatic neuromata now and then occur in the course of nerves which have been injured but not severed.

The statements of authors concerning the new-formation of the axis-cylinder in divided nerves are very discordant. WALLER, SCHIFF, RINDFLEISCH, CORNIL, RANVIER, EICHHORST, and others assert that it is due to longitudinal subdivision and growth in length of the old axis-cylinders. PHILIPPEAU, VULPIAN, REMAK, LEEGARD, NEUMANN, DOBBERT, DASZKIEWICZ, and others regard the new cylinder as derived from the peripheral end; LEEGARD believing that it arises from the nuclei of the neurilemma, REMAK from the uninjured and surviving cylinders, DASZKIEWICZ from the surviving segments of the old and partially degenerate cylinders, NEUMANN and DOBBERT from a protoplasmic mass produced by a chemical transformation of the medullary sheath and axis-cylinder. NASSE, GÜNTHER, SCHÖN and STEINRÜCK assert that the new cylinders grow from the old fibres of both ends: LEUT, EINSIEDEL, WEIR-MITCHELL, BENECKE, and GLUCK, from the primitive sheaths of both ends; LAVERAN and HERZ refer their origin to the white blood-cells, HJELT and WOLBERG to the cells of the perineurium.

As the text shows we incline to the view of those who derive the new nerve-fibres from the old nerves of the central end. The subdivision of the axis-cylinder is the essential part of the process, though it is perhaps not impossible that a new-formation of nerve-fibres may start from the cells or nerve-corpuscles or nuclei on the sides of the sheaths of Schwann. At any rate it is remarkable how frequently in degenerating nerves we find these cells (Fig. 285 *dd*.) swollen up and containing several nuclei: sometimes indeed they give off processes which much resemble axis-cylinders (*d*<sub>2</sub>). Until we have more information on the subject however it is more probable that these cells form merely the sheaths for the new axis-cylinders. CATTANI asserts that new axis-cylinders are formed within the nucleated protoplasmic mass which he has observed filling the primitive sheath of degenerating nerves.

The hypothesis that nerve-fibres may grow from granulation-cells or from the connective-tissue cells of the perineurium, endoneurium, or epineurium, is contrary to all histogenetic analogy. The nerves throughout their length are originally outgrowths from the central nervous system (BALFOUR, HENSEN, HIS, KÖLLIKER, etc.), and it is extremely unlikely that in later life they can arise from indifferent connective-tissue cells: this would be at variance with all our experience on the subject of the regeneration of specific tissues. The authors who have made the assertion do not advance any convincing arguments in its favor.

Those who believe that after section of a nerve the axis-cylinders of the peripheral end remain intact assume that the ends of the severed cylinders reunite by the intercalation of a new piece of tissue. WOLBERG describes this as taking place by the growth of strings of spindle-cells from the epineurium. When the reunion does not take place till the medullary sheath disintegrates he speaks of the process as regeneration in the strict sense of the term. If reunion takes place before the sheath disappears he speaks of it as union by first intention, and distinguishes a mediate and an immediate variety. In the former the union is brought about by means of new-formed intercalary fibres, in the latter by direct adhesion of the severed ends of the cylinders and primitive sheaths. The existence of the mediate variety he claims to have experimentally proved. Such a union by first intention is very doubtful: GLUCK's and WOLBERG's experiments do not appear to prove it, and it is probable that mistakes have arisen from the rapid restoration of function that sometimes takes place by means of abnormal nervous anastomoses and supplementary fibres. The secondary or mediate union by means of intercalary fibres appears impossible, the cylinders of the peripheral end being already degenerate: and for the same reason the statements of GLUCK and others that a piece of nerve cut from one animal may become united to the two ends of a severed nerve in another must be regarded as resting on error.

## CHAPTER CII.

### INFLAMMATION OF PERIPHERAL NERVES AND GANGLIA.

669. **Neuritis**, or the inflammation of nerves, is characterized anatomically by the presence of an exudation in their fibrous framework. If the exudation is chiefly liquid and the blood-vessels are still filled, the inflamed nerve looks red, and swollen, and abnormally moist: if the exudation is cellular (Fig. 287) and the hyperæmia has disappeared there are no apparent signs of the affection, though any hæmorrhage that has taken place may be indicated by reddish or brownish-yellow discoloration.

In simple nerves the migrated leucocytes lie chiefly in the thicker trabeculæ of the endoneurium (Fig. 287 *d*) through which the vessels

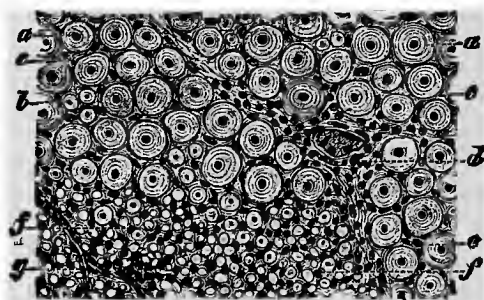


FIG. 287. CHRONIC NEURITIS.

(Hardened in Müller's fluid and alcohol, stained with hæmatoxylin and carmine, and mounted in Canada balsam:  $\times 150$ .)

*a*, normal thick nerve-fibre  
*b*, normal fine nerve-fibre  
*c*, endoneurium  
*d*, blood-vessel, and trabeculæ of endoneurium infiltrated with leucocytes

*e*, leucocytes between the nerve-fibres  
*f*, thickened endoneurium with small spaces devoid of nerve-fibres and a few thin fibres still persisting.  
*g*, longitudinal section of a blood-vessel

run, though they may also pass in between the individual nerve-fibres (*c e*).

In compound nerves (Fig. 288) the exudation frequently lies almost entirely in the epineurium. The perineurium of the bundles and of the nerve generally is usually much less densely infiltrated.

Slight inflammations resolve without leaving any trace: severer attacks result in degeneration of some of the nerve-fibres. If the in-

inflammation is suppurative or gangrenous the nerve rapidly breaks down and perishes, becoming of a dirty yellowish-white, gray, or grayish-green. The connective-tissue elements are however less vulnerable and long resist dissolution.

If the affection is chronic, degeneration of the nerve-fibres ultimately sets in, with the breaking up of some of the medullary sheaths. The axis-cylinders persist for a long time, though they too at length perish; and thus a certain number of the fibres disappear outright, the sheaths of Schwann collapsing (*f*). Wherever an axis-cylinder decays degeneration takes place all down the peripheral portion of that fibre (Art. 667). As the medullary sheaths break down the tissue of the nerve is beset with drops of myeline and granule-carrying cells.

In process of time the chronic inflammation leads to thickening and condensation of the connective tissue, and this with the atrophy of the nerve-elements gives the nerve by degrees the appearance of a fibrous cord. Whether the nerve as a whole is thicker or thinner than in health depends on the proportion between the fibrous hyperplasia and the nervous atrophy. Both in simple and in compound nerves the inflammation may and sometimes does extend over the whole cross-section. In compound nerves the separation of the bundles becomes less distinct, though it is not obliterated even when the atrophy and fibrous changes are very advanced. When the process has been accompanied by hæmorrhage the altered tissue is frequently pigmented.

Chronic neuritis accompanied by great fibrous hyperplasia has been called by VIRCHOW **proliferous neuritis**: if it extends upwards or downwards we speak of it as ascending or descending neuritis respectively.

One of the commonest causes of neuritis is mechanical injury (cutting, bruising, etc.) by a wound or blow: the inflammation results in fibrous hyperplasia, but if it becomes septic suppuration or gangrene may set in.

Moreover the inflammatory process sometimes extends to a nerve from the adjacent tissues; thus nerves running through a wound may undergo granulation or even suppuration without having received any direct injury, and the like extension takes place in the case of other inflammations.

For example, it is extremely common for cerebrospinal nerves traversing an inflamed meninges to be themselves invaded by the inflammatory infiltration. And inflammations of the bones lead to indirect degeneration by compression or to direct inflammation of the nerves that traverse them. This also happens to nerves lying in the neighborhood of chronically inflamed or tuberculous lymphatic glands. It is not uncommon for instance for caseous glands in the neck, beside the trachea, or at the root of the lung, to press upon contiguous nerves, like the vagus and its branches, to irritate them into inflammation, and so to

bring about their degeneration. In the pelvis inflammations of the bladder or of the internal generative organs are apt to extend to the cellular connective tissue and so to the rich nerve-plexuses of that region.

These forms of neuritis are consecutive or secondary, but other forms occur in which the irritant inducing the inflammation is brought to the nerve directly by way of the blood or lymph. These irritants are so far as we know chiefly of an infective nature: thus in typhus (BERNHARDT), small-pox (JOFFROY), typhoid (NOTHNAGEL, LEYDEN, EISENLOHR), and diphtheria (OERTEL, CHARCOT, BUHL, DÉJÉRINE) we meet with simple or multiple neuritis, which we can only regard as direct results of the general infection.

Recently BÄELZ and SCHEUBE have shown that the epidemic disease of India and Japan known as *beriberi* or *kakke* is characterized by the appearance of multiple neuritis: it has therefore been designated (BÄELZ) as *panneuritis epidemica*.

It does not appear that there is any affection in Europe exactly corresponding to the Japanese *kakke*, but a form of multiple neuritis (LEYDEN) has more than once been described under the names of polyneuritis (PIERSON) and neuritis disseminata (ROTH). Whether this has any analogy to the infective disease, as PIERSON suspects, is still a very open question. Cold is spoken of by many as a cause of multiple neuritis, but probably in most cases some kind of infection or poison is at work. ROTH has shown that a purulent inflammation (as in parotitis) which involves a nerve-trunk may be the starting point of multiple neuritis.

**Tuberculous and syphilitic inflammation** affect chiefly the intracranial portions of cranial nerves and the spinal nerve-roots in connection with meningeal tuberculosis and syphilis respectively.

Little is known of tuberculosis or syphilis of the peripheral nerves. Foci of some size are most frequently observed in the optic nerve, and give rise to extensive tuberculous destruction. Elsewhere nerves are seldom involved except by extension of tuberculous inflammation from diseased glands.

**Leprous inflammation** is especially apt to attack the nerves, the disease being in fact chiefly characterized by its thus involving the peripheral nervous system: a particular form of leprosy is distinguished as *lepra nervorum anæsthetica*, or *lepra mutilans* (Arts. 131, 206, 392, 659, and HOGGAN, *Arch. d. physiol.* 1882). The settlement of the lepra-bacilli excites an intense inflammation, accompanied by cellular infiltration and followed by degeneration of the nerve-fibres and hyperplasia of the fibrous tissue. Fusiform thickenings and tuberosities of considerable firmness and size are thus produced in the course of the several nerves. The diseased tissue contains lepra-bacilli, some lying free and others being enclosed in cells.

We know little concerning the **inflammations of the ganglia**: they apparently occur under the same conditions as those of the nerves, and like them they are characterized by cellular infiltration, fibrous hyperplasia, and degenerative atrophy of the nerve-elements.

In severe cystitis and pyelonephritis and in inflammation of the internal generative organs in women paralysis of the lower limbs is sometimes a symptom. REMAK (*Med. Central-Zeitung* 1860) and LEYDEN (*Sammlung klin. Vorträge* 2, 1870) explain this as due to a progressive or wandering neuritis, which has been called **neuritis disseminata migrans** (LEYDEN). The experimental researches of WEIR-MITCHELL (*Injuries of nerves* London 1872), TIESLER (*Ueb. Neuritis* In. Diss. Königsberg 1869), FEINBERG (*Berl. klin. Woch.* 1871), KLEMM (*Ueb. neuritis migrans* In. Diss. Strasburg 1874), NIEDICK (*Arch. f. exp. Path.* VII. 1877), ROSENBAACH (*ibid.* VIII.), and TREUB (*ibid.* X.) fail to confirm this explanation. It is much more likely that in the affections named the pelvic plexuses are compressed or directly inflamed by extension from the inflammation of the cellular connective tissue (pelvic cellulitis). See discussion by ADAMS and others (*Lancet* 2; 1880).

On multiple neuritis:—DUMÉNIL, *Gaz. hebdom.* 1864, 1866; LEYDEN, *Ueb. Reflexlähmung, Samml. klin. Vorträge* 2, 1870, *Charité-Annalen* v., *Arch. f. Psych.* VI., *Zeitschr. f. klin. Med.* I. 1880; CASPARI, *ibid.* V.; GRAINGER STEWART, *Edin. Med. Journ.* 1881; EICHEHORST, *Virch. Arch.* vol. 69; JOFFROY, *Arch. de physiol.* 1879; EISENLOHR, *D. Arch. f. klin. Med.* XXVI.; MARCHAND, *Virch. Arch.* vol. 81; ERB, *Ziemssen's Cyclop.* XIII.; NOTHNAGEL, *Samml. klin. Vorträge* 103, trans. New Syd. Soc. London 1877; PIERSON, *Ueb. Polyneuritis acuta, ibid.* 229; GEPPERT, *Multiple Neuritis, Charité-Annalen* 1883; STRÜMPFEL, *Arch. f. Psych.* XIV. (*Neurolog. Centralb.* 1884); MÜLLER, *ibid.*; VIERORDT, *ibid.*; ROTH, *Neuritis dissem. acutissima, Corresp. f. Schweizer Aerzte* 1883; DUBOIS, *Multiple Neuritis, ibid.*; BÄELZ, *Kakke oder Beriberi Yokohama* 1882, *Zeitschr. f. klin. Med.* IV. 1882; SCHEUBE, *Virch. Arch.* vol. 95, *D. Arch. f. klin. Med.* XXXI., XXXII., *Die japanische Kakke* Leipzig 1882; HIRSCH, *Handb. d. hist. geog. Path.* (2d edition), trans. by CREIGHTON (New Syd. Soc.) II. London 1885 (beriberi, with full references); CASPARI, *Zeitschr. f. klin. Med.* 1883; DÉJÉRINE, *Arch. de physiol.* 1884; WEBBER, *Archives of medicine* 1884; OPPENHEIM, *D. Arch. f. klin. Med.* XXXVI. 1885; BUZZARD, *Paralysis from peripheral neuritis* London 1886.

On neuritis in infective diseases:—BERNHARDT, *Arch. f. Psych.* IV.; JOFFROY, *loc. cit.*; NOTHNAGEL, *D. Arch. f. klin. Med.* IX. (1872); EISENLOHR, *Arch. f. Psych.* VI.; CORMACK, *Clinical Studies* London 1876; MURCHISON, *Continued fevers* London 1884; CHARCOT, *Diseases of the nervous system* II. London 1880; BUHL, *Zeitschr. f. Biol.* III.; OERTEL, *D. Arch. f. klin. Med.* VIII.; DÉJÉRINE, *Arch. d. physiol.* V. 1878; BUZZARD, *Lancet* 1, 1879, and *op. cit.*; PITRES and VAILLARD, *Rev. de médecine* 1885; ROSS, *Diseases of the nervous system* II. London 1883 (with many references); P. KIDD, *Med. chir. Trans.* LXVI. 1883 (diphtherial paralysis).

On neuritis in herpes zoster see Art. 383; DUBLER, *Neuritis bei Herpes zoster* In. Diss. Basle 1884.

## CHAPTER CIII.

### TUMORS.

670. Most of the **tumors** which occur in the nerves and their ganglia are developed from connective tissue, and consist essentially of some modification of that tissue, the nerve-elements forming little or no part of their structure.

The fibrous hyperplasia usually starts from the perineurium of the nerves or nerve-bundles, but occasionally from the epineurium or endo-

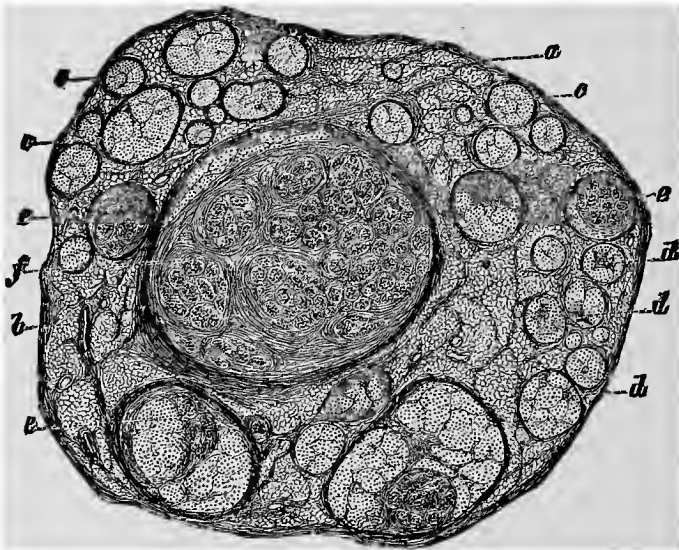


FIG. 288. MULTIPLE FIBROMA OF A NERVE OF THE SCIATIC PLEXUS.

(Hardened in Müller's fluid, stained with carmine, and mounted in Canada balsam:  $\times 10$ .)

- |   |  |
|---|--|
| a, general perineurium                            | e, more advanced fibroma within a nerve-bundle |
| b, epineurium containing numerous fat-cells       | containing atrophied fibres                    |
| c, nerve-bundle enclosed in a special perineurium | f, large fibroma-nodule within a bundle whose  |
| d, commencing fibroma in the endoneurium          | perineurium is thickened                       |

neurium (Fig. 288 *d e f*). The nerves are embedded or pervaded by the new tissue, according to its starting-point, and by gradual compression become atrophied and break down. If there is any accompanying

nervous hyperplasia it probably takes place by the longitudinal subdivision and growth of pre-existing fibres: the new-formed fibres are at first naked, but some of them receive a medullary sheath in course of time.

The commonest neoplasm affecting the nerves is **fibroma** (Fig. 288): there are two forms—the soft and cellular, and the firm and fibrous. Tumors really deserving the name of **neuroma**, *i. e.* consisting essentially of new-formed nerve-fibres, are rare; and still rarer, if they exist at all, are tumors containing new-formed ganglion-cells, though these are described under the name of cellular or **ganglionic neuroma**.

Fibromata incorrectly described as neuromata are solitary or multiple, and in the latter case are congenital or at least appear soon after birth. Obviously the foundation of these structures is laid during foetal life; sometimes their heredity can be demonstrated. They occur in nerve-trunks and on their finest twigs and branches, forming fusiform, nodular, or very elongated thickenings of the nerve or nerves. Sometimes a nerve is found thickened over its whole extent, with perhaps occasional fusiform swellings.

The spinal nerves are the most frequent seat of these growths, though they also occur on the cranial nerves. Sometimes all the nerves are simultaneously affected, even the finest branches showing thickenings and knotty swellings. Thus all the branches of the vagus in the lungs and stomach, or those of the sympathetic in the liver, have been described as covered with fibromata, but these cases are very rare. Not infrequently however we find the smaller cutaneous nerves beset with small round or flat usually soft tumors, some being buried in the skin, others protruding. These growths are known as **fibroma molluscum** (VON RECKLINGHAUSEN, Art. 399). The cutaneous nodules are often in great numbers and extend over the territory of a particular nerve or over the whole body; they are sometimes accompanied by neurofibromata of the internal organs. Sometimes too between the nodules extensive hyperplasia of the subcutaneous and cutaneous fibrous tissue takes place, and large soft masses and folds are thus produced and known as **pachydermatocele**, elephantiastic molluscum, elephantiasis mollis or neuromatous elephantiasis (Art. 399). The smallest growths may only be visible with a lens, the largest are sometimes the size of a kidney or larger.

The fusiform or nodose thickening of a nerve is often due to a single tumor; but a nerve-trunk sometimes includes several nodules in its cross-section, some lying in all or most of its bundles (Fig. 288). A central node will give rise to a fibrous tumor surrounded by nerve-bundles and a perineurium: when the fibroma starts in one of the outside bundles it at length appears as if seated on the nerve-trunk.

At times most of the nodes are confined to a single nerve. Other nodes, and these occasionally very large, consist of a plexus of many nerves united into a mass by hyperplastic fibrous tissue. The nerves are all

thickened, nodular, fusiform, convoluted, twisted, or otherwise distorted (Fig. 289), so that a coil of ravelled and varicose cords is formed, the whole being held together by fibrous tissue. Such a growth is described as a **plexiform neurofibroma**. According to P. BRUNS the cords contain numerous nerve-fibres, and it is therefore probable that new-formed nerve-fibres as well as fibrous tissue take part in its construction.

Of the other connective-tissue growths sarcoma, myxoma, and lipoma occur in connection with the nerves. The external forms they assume are similar to those of fibroma, but they are never multiple.



FIG. 289. PLEXIFORM NEUROFIBROMA OF THE SACRUM.

(Natural size: from a drawing by P. BRUNS.)

a, convoluted strands laid bare by dissection

b, as they appear covered with fibrous tissue

On neurofibroma:—VIRCHOW, *Krankhafte Geschwülste* III. (1863); HITCHCOCK, *Amer. Journ. med. sci.* 1862; CZERNY, *Arch. f. klin. Chir.* XVII. 1874; P. BRUNS, *Virch. Arch.* vol. 50; VON RECKLINGHAUSEN, *Ueb. mult. Fibrome d. Haut* Berlin 1882; KÖBNER, *Virch. Arch.* vol. 93; LAHMANN, *ibid.* vol. 101; NICAISE, *Internat. ency. of surgery* III. London 1883; PRUDDEN, *Amer. Journ. med. sci.* 1880 (with cases); COURVOISIER, *Die Neurome* Basle 1886 (with numerous references); CHAVASSE, *Med. chir. Trans.* LXIX. 1886. Tumors (fibroma, fibrosarcoma, neurofibroma) occur more frequently on the auditory than on other cranial nerves; see VIRCHOW, (*op. cit.*), and AXEL KEY (*Särskildt af Nordiskt med. Arkiv* XI. 1879).

## INDEX OF AUTHORS CITED.

*(The numbers refer to the articles.)*

- Abelin 10  
 Ackermann 7: 495, 497, 498, 631, 635  
 Acland 623 *b*  
 Adami 520, 530  
 Adamkiewicz 628, 630, 644, 647  
 Adams 11: 530, 669, 648  
 Addison 96: 261: 565  
 Adriani 648  
 Aeby 625, 633  
 Afanassiew 490: 530, 623 *b*  
 Ahlfeld 1, 5, 9, 12, 13, 179: 630, 632  
 Albertoni 623 *a*  
 Albrecht 206  
 Alexander 479  
 Allbutt 659  
 Althann 635  
 Althaus 648, 659  
 Amburger 604  
 Ammann 623 *b*  
 Amozan 397  
 Amyot 631  
 Anderson 18  
 Andreæ 607, 662  
 Andral 94  
 Angel-Money 659  
 Anger 152  
 Appert 96  
 Argatzinski 528  
 Arloing 206  
 Armauer-Hansen 117, 131, 185, 206  
 Arndt 63: 316: 637, 642, 650, 656, 663  
 Arnold 13, 27, 74, 84, 86, 89, 97: 296,  
 332, 342, 501: 550, 579, 584, 600, 613,  
 663, 664  
 Arnott 437  
 Arnstein 152: 262, 437, 438  
 Artaud 647  
 Asch 575  
 Assmus 271  
 Atkinson 542  
 Auerbach 255  
 Aufrecht 85, 108, 127, 206: 391, 459,  
 498: 535, 539, 543, 552, 613, 620  
 Auspitz 128: 388, 392  
 Auerbeck 565  
 Babes 542, 543, 550, 602, 605, 613, 618  
 Babesiu 399: 647  
 Babinski 647  
 Baelz 620, 669  
 v. Baer 11  
 Baillarger 623 *a*  
 Baillie 118  
 Baker-Brown 10  
 Bakowiecki 667  
 Balfour 74, 75, 86, 89: 348: 516, 668  
 Ballard 206  
 Balmer 613  
 Balzer 591  
 Bambeke 10  
 Bamberger 272, 279, 495: 523, 639  
 Bancroft 235  
 Barbieri 54  
 Bard 662  
 Bardeleben 634  
 v. Bärensprung 327, 383, 500: 607  
 Barker 315, 437, 438  
 Barlow 327: 565, 659  
 Bartels 533, 534, 536, 539, 591  
 Barth 235: 623, 646, 647  
 Barwell 308  
 Bary (de) 216, 220  
 Basch 388: 667  
 Bastian 604, 625, 635  
 Bateman 400  
 Bauchet 623  
 Bauer 52: 490, 631  
 Baumgarten 8, 108, 127: 255, 295, 314,  
 342: 612, 613, 625, 641, 659, 661  
 Baumgärtner 623 *a*  
 Bäumler 128: 327, 441: 625  
 Bayer 533, 594, 662  
 Bayle 118: 656  
 Bazin 412  
 Beale 532  
 Bechterew 626  
 Beck 619, 623, 665  
 v. Becker 61  
 Beckmann 528, 551, 623  
 Beer 539  
 Beger 578  
 Behrend 359, 392, 412  
 Beigel 397  
 Bekmann 391  
 Beloussow 498  
 Bence-Jones 52  
 Benedikt 634, 642, 659  
 Beneke 272, 278, 286, 492, 510: 532, 667,  
 668  
 Benjamin 662  
 Bennett (Hughes) 260

*(The numbers refer to the articles.)*

- Berger 578, 621, 625, 647  
 Bergmann 191, 197, 201: 342, 479: 644, 645, 658  
 Bernhardt 663, 665, 669  
 Beschorner 575  
 Besnier 322  
 Beumer 517, 522  
 Bezold 221  
 Bichat 266  
 Bidder 485: 662  
 Biedert 612  
 Biefel 573  
 Bienstock 479  
 Bierhoff 471  
 Biermer 261: 539, 582, 594, 604  
 Bilharz 231, 239  
 Billard 433, 439  
 Billroth 86, 109, 149, 156, 159, 161, 163, 171, 183, 184, 185, 209: 321, 324, 334, 344, 346, 438: 568, 653, 654, 663  
 Binswanger 630, 633, 634, 646  
 Binz 52: 490  
 Birch-Hirschfeld 69, 204, 206, 209: 262, 295, 320, 327, 328, 358, 391, 457, 490, 495, 500, 502, 515: 607, 660  
 Bircher 623 *a*  
 Birdsall 667  
 Bischoff 625, 640  
 Bizzoli 631  
 Bizzozero 35, 81, 108, 114, 156: 252, 260, 261, 263, 317, 319, 400: 664  
 Blaschko 667  
 Blix 10  
 Block 222: 504  
 Boas 262: 530  
 Boddaert 601  
 Bochdalek 439  
 Böck 400  
 Bockhart 564  
 Bögehold 177: 623  
 Böhm 13: 457, 470: 530  
 Bohme 358  
 Bohn 383, 433, 434, 439  
 Bokai 564  
 Boll 177: 626, 628, 638, 639  
 Bollinger 125, 127, 133, 134, 135, 197, 206, 221, 247: 262, 400, 433, 436: 574, 618, 620  
 Boser 196  
 Boström 153: 518, 522, 530, 534, 556  
 Böttcher 79, 99, 108: 260, 460, 491: 530  
 Bouchard 304: 542, 626, 644, 646  
 Bouchardat 612  
 Boucher 623 *b*  
 Bouillaud 625  
 Bouley 201  
 Bourdon 641  
 Bourneville 650  
 Bowman 94  
 Bozzolo 232: 664  
 Braidwood 204  
 Bramwell (Byrom) 261: 626, 633, 646, 650  
 Brauell 206  
 Brault 490: 523, 534, 586, 539, 540, 551, 595  
 Braun 249: 516, 622  
 Braune 13, 632  
 Braus 661  
 Brefeld 186, 212, 215, 217, 219, 223  
 Brehmer 612  
 Brenner 460  
 Bresgen 567  
 Bretonneau 425  
 Brieger 191, 192, 197, 201, 204: 479, 498: 576, 623, 643  
 Bright 278, 383, 498: 539, 551, 555  
 Brinton 460  
 Bristowe 153: 295, 495: 577, 620  
 Broadbent 661  
 Broca 625  
 Brodowski 109, 153: 391, 490: 556  
 Brookhouse 479  
 Brosin 556  
 Brown-Séguard 589, 638  
 Bruberger 661  
 Brücke 94: 253, 453  
 Brückner 551  
 Brunelli 648  
 Bruns 154: 399, 434: 569, 575, 621, 623 *a*, 653, 667, 670  
 Bruylants 605  
 Bruzelius 645  
 Buchholtz 190  
 Buchner 186, 190, 193, 201, 209, 211  
 Buchwald 523, 539, 650  
 Bückling 495  
 Budd 453, 460, 498, 500  
 Budge 94  
 Bugnion 231  
 Buhl 9, 11, 120, 206: 271, 272, 279, 436, 458: 539, 582, 587, 595, 600, 601, 603, 604, 606, 613, 637, 669  
 Buob 621  
 Burckhardt 436  
 Burger 362: 565  
 Burkhard 84  
 Burkhardt 282: 533  
 Burow 61: 575  
 Bury 648  
 Busch 18. 88  
 Butlin 165: 402: 575  
 Buttenwieser 631  
 Buzzard 647, 648, 661, 669  
 Cadet 261  
 Caillé 500  
 Calmeil 656  
 v. Campe 660  
 Canalis 623 *a*  
 Capitain 542  
 Carl 498  
 Carré 589  
 Carswell 613  
 Carter 201, 207, 222: 531  
 Carville 625  
 Caspar 457  
 Caspari 669

*(The numbers refer to the articles)*

- Caton 96  
 Catiano 262  
 Cattani 667, 668  
 Cavafy 623 a  
 Cayley 31  
 Ceci 193  
 Cervato 575  
 Challand 513  
 Chamberland 188  
 Champneys 517  
 Chantreuil 623  
 Charcot 28: 260, 302, 303, 304, 383, 498:  
     526, 531, 536, 539, 579, 589, 625, 626,  
     627, 628, 636, 638, 641, 644, 646, 647,  
     648, 650, 659, 661, 667, 669  
 Charrin 542  
 Chauveau 42, 125, 127, 231  
 Chavasse 561, 670  
 Cheadle 650  
 Cheyne (Watson) 201, 204: 361: 564  
 Chiari 179: 391, 396, 404, 415: 565, 574,  
     595, 619, 623, 630, 633, 663  
 Chotinsky 551  
 Christison 259: 539  
 Christoph 145  
 Church 302, 358  
 Chvostek 500  
 Cienkowski 223  
 Clapton 640  
 Clarke 437: 639, 647  
 Claudius 13  
 Claus 643  
 Cleland 5: 630, 632  
 Clemens 645  
 Coats 636, 659  
 Cobbold 226, 228, 233, 234, 235, 239, 240:  
     663  
 Cohen (Solis) 573  
 Cohn 183, 184, 185, 186, 191, 192, 211:  
     619  
 Cohnheim 18, 19, 21, 22, 25, 27, 30, 33,  
     36, 47, 62, 79, 80, 84, 94, 95, 97, 99,  
     117, 119, 125, 136, 140, 153, 177, 179,  
     180, 221: 261, 277, 279, 324, 328, 344,  
     351, 425, 460, 484, 490: 521, 523, 525,  
     526, 530, 531, 540, 556, 584, 588, 589,  
     680, 619, 620, 624, 622  
 Colberg 596  
 Coleman 440  
 Colin 127, 201: 262: 550  
 Colomatti 507  
 Colosanti 657  
 Colucci 492  
 Cordua 68: 349  
 Cormack 669  
 Cornevin 206  
 Cornil 58, 66, 76, 84, 120, 128, 156, 206:  
     258, 292, 296, 328, 332, 342, 344, 391,  
     425, 471, 490, 491, 498, 500: 523, 528,  
     533, 535, 536, 537, 539, 540, 542, 550,  
     551, 569, 572, 575, 582, 595, 596, 602,  
     605, 607, 613, 618, 622, 623, 647, 662,  
     663, 668  
 Corrigan 582  
 Cossy 667  
 Cotard 651  
 Coupland 261: 565: 604  
 Courty 153  
 Courvoisier 670  
 Couty 266  
 Coze 204, 211  
 Creighton 127, 174: 495: 623 a, 669  
 Crisp 471  
 Crocq 600  
 Crooke 474  
 Cruveilhier 515: 577, 630, 632, 654  
 Cuboni 206  
 Cullen 94  
 Cunningham 74, 193, 222  
 Curling 13  
 Curnow 31: 514  
 Curshmann 579, 596, 625  
 Cyon 648  
 Czerny 154: 308, 399: 670  
 Da Costa 565  
 Dallinger 185  
 Dalton 625  
 Damaschino 470: 659  
 Damsch 392  
 Danjoy 526  
 Danzel 178  
 Dareste 3, 7, 10: 630, 632  
 Daszkiewicz (Korybutt) 667, 668  
 Dättwyler 460  
 Davaine 204, 206, 209, 226, 230, 231,  
     234, 235, 240, 250: 663  
 Davida 641  
 Davidsohn 515  
 Davies 621  
 Day 31  
 Debove 537: 626  
 Deiters 626, 639  
 Déjérine 641, 647, 648, 667, 669  
 De la Croix 190, 630  
 Demiéville 398  
 Demme 42: 261, 433, 454: 567, 577, 612,  
     613, 621, 622, 623, 623 a, 631  
 Denissenko 640  
 Dennis 439  
 Dentan 638  
 Depaul 13: 607, 623 b  
 Désert 315  
 Dessoir 437  
 Dickinson 58, 62: 526, 530, 531, 532, 537,  
     539, 542, 550, 551, 552, 631, 641, 650  
 Dieckerhoff 618  
 Dilg 271  
 Dittmer 5  
 Dittrich 587  
 Dobbert 668  
 Dodds 625  
 Dönitz 5  
 Dowse 661  
 Drasch 74  
 Dreschfeld 490: 530, 602, 613, 641, 647  
     648, 650, 659, 663  
 Drummond 659

*(The numbers refer to the articles.)*

- Drysdale 185  
 Dubler 669  
 Dubois 623 b  
 Du Casal 561  
 Du Castel 272  
 Duchamp 249  
 Duchenne 647  
 Duckworth (Dyce) 400: 623 a  
 Duclaux 191, 201, 219  
 Duguet 640  
 Duhring 359, 367, 377, 392, 396, 399  
 Dujardin-Beaumetz 659  
 Duménil 647, 667, 669  
 Dumolard 623  
 Dunin 539  
 Durand 561  
 Durante 255  
 Duret 625, 628  
 Durham 568  
 v. Dusch 620  
 Duval 627  
 Duzan 179  
  
 Eberth 56, 59, 74, 79, 84, 87, 99, 153,  
     204, 206: 281, 282, 316, 326, 328, 332,  
     344, 474, 492: 539, 542, 556, 587, 602,  
     619, 622, 623 b, 663  
 Ebstein 28: 517, 531, 535, 550, 552, 555,  
     556, 561  
 Ecker 17: 408: 621, 625  
 Eckstein 534  
 Edinger 594, 625, 641  
 Edwards 585  
 Ehebald 594  
 Ehrlich 127: 260, 261, 262, 295: 643  
 Eichhorst 261, 274, 407: 626, 635, 667,  
     668  
 Eickler 304: 636  
 Eichstedt 412  
 Eickholt 650  
 Eidam 189  
 Eimer 55, 250  
 Einsiedel 667, 668  
 Eiselsberg 654  
 Eisenlohr 642, 659, 667, 669  
 Eisenmann 94  
 Eldridge 577  
 Eliaschoff 535  
 Elsässer 453  
 Emmerich 602  
 Emmert 94  
 Emminghaus 656  
 Engelken 659  
 Engelmann 190: 667  
 Engelstedt 661  
 Eppinger 63, 161, 204: 307, 490: 522,  
     569, 570, 572, 573, 574, 575, 576, 577,  
     594, 604, 622, 663  
 Erb 260: 626, 627, 632, 644, 645, 646,  
     647, 648, 659, 663, 667, 669  
 Erler 651  
 Erman 490  
 Esoff 397  
 Etard 191  
  
 Etter 659  
 Eulenburg 397  
 Eulenberg 648, 667  
 Eve 441: 551, 556  
 Ewald 278, 453: 526, 539, 639  
 Ewart 184, 186, 189, 204, 207  
 Ewetzky, 87, 108, 163  
 Exner 625  
  
 Fagge (Hilton) 62: 277, 309, 399, 400:  
     550, 623 a  
 Falkenheim 667  
 Falkson 663  
 Farre 552  
 Fauconneau-Defrésne 514  
 Fauvel 575  
 Fehleisen 204: 375  
 Fehr 537  
 Feinberg 669  
 Feld 596  
 Feltz 125, 204: 479  
 Fenley 619  
 Fenwick 453, 460  
 Ferber 663  
 Féré 625  
 Ferrein 511  
 Ferrier 625, 626, 627, 641, 646, 647  
 Feuerstāk 584  
 Feuerstack 261: 596  
 Feustel 592  
 Fick 630  
 Fiedler 503: 640  
 Filehne 262, 457: 598, 645  
 Fischer 18: 633, 640, 645, 653, 667  
 Fischel 206: 320: 539, 542  
 Fitz 211, 219: 582  
 Flechsig 625, 626, 627, 630, 633, 646,  
     647, 648, 657  
 Fleischer 260: 565  
 Fleischmann, 377, 439, 5632  
 Flesch 633, 634  
 Fleming 133  
 Flemming 46, 74, 75, 84  
 Flourens 625  
 Flournoy 266  
 Foà 255, 261, 318, 498  
 Fokker 209  
 Forel 625, 627, 641, 659  
 Formad 204  
 Förster 1, 4, 5, 7, 10, 13: 271, 404: 539,  
     544, 604, 607, 619, 622, 623, 625, 630,  
     632  
 Fournier 648, 661  
 Fox (Wilson) 125, 178: 460  
 Fox (Tilbury) 385, 402  
 Fraenkel 125: 490, 515: 532, 535, 567  
 Fraentzel 613  
 Frankenhäuser 261: 579  
 Franks 567  
 Frerichs 490, 495, 498, 500, 504, 510, 515:  
     535, 539, 551  
 Freund 500: 623 a  
 Frey 596, 601  
 Friedberg 18

*(The numbers refer to the articles.)*

- Friedländer 204, 206: 295, 309, 391, 392,  
 474, 479: 539, 540, 542, 544, 584, 596,  
 601, 602, 638, 667  
 Friedleben 623 *b*  
 Friedmann 639, 650  
 Friedreich, 18, 58, 59, 61, 221: 320, 492,  
 513, 515: 530, 620, 621, 637, 647, 648,  
 650  
 Frisch 199  
 Fritsch 625  
 Frobenius 602  
 Froisier 630  
 Frommann 647, 648, 650  
 Fronista 174  
 Frommüller 645  
 Fuhr 623 *a*  
 Fürbringer 221: 516, 534, 542, 620  
 Fürst 3: 575, 577, 585  
 Fürstner 625, 633, 637, 641  
  
 Gaffky 189, 204, 205, 206, 209, 211: 474  
 Galabin 539  
 Galen 93  
 Galton 625  
 Gamgee 35, 54, 68: 258, 259  
 Ganguillet 662, 663  
 Gannet 135  
 Ganser 641  
 Garrod 259: 526, 531  
 Gärtner 190  
 Gaucher 534, 542  
 Gaudard 659  
 Gaule 120  
 Gaultier 550  
 Gautier 191  
 Geber 377, 380, 397  
 Geddes 207  
 Gee 120: 327  
 Gegenbaur 623 *b*  
 Gelmo 633  
 Georgjevic 315  
 Geppert 669  
 Gerhardt 327, 397, 460: 574, 576, 578,  
 589, 591, 607, 662  
 Gerlach 5, 17, 127: 626, 639  
 Gessler 667  
 Germont 523  
 Geuzmer 621  
 de Giacomi 613  
 Giacomini 625  
 Gibbs 127, 206: 613  
 Gibler 384  
 Gierke 434: 627, 639  
 Gies 437  
 Gilbert 667  
 Giovanni 292, 299  
 Gjorgewic 152  
 Glaser 612, 662  
 Glax 97  
 Glozier 233  
 Gluck, 667, 668  
 Gluge 112: 658  
 Golgi 625, 628, 639, 662  
 Goll 626  
 Goltz 625  
 Golubew 86  
 Gombault 498: 526, 623, 626, 647, 661,  
 667  
 Goodhart 302, 490: 565, 607  
 Goodsir 87, 94, 174  
 Gordon 178  
 Gore 621  
 Gosselin 438  
 Gottstein 567  
 Gowers 260, 295, 328: 625, 641, 648, 650,  
 659, 661  
 Grancher 118: 582  
 Grandidier 607  
 Grassi 231  
 Graves 572  
 Grawitz 11, 214, 219, 222, 223, 224: 279,  
 436: 522, 528, 539, 556  
 Greenfield 130, 204, 206: 271: 530, 539,  
 540, 550, 661  
 Greenhow 565, 600  
 Greenish 556  
 Greiff 651, 656, 661  
 Griesinger 231, 239: 502: 663  
 Griffine 84  
 Griffini 622  
 Grimm 637  
 Grohe 219, 222  
 Gros (Leon) 661  
 Gross 358  
 Gruber 10, 11, 75: 517, 577  
 Gruby 411  
 Grundler 623 *a*  
 Gubler 500  
 Gudden 522, 625, 627, 633, 641, 646  
 Guillebeau 37: 324: 526, 528  
 Guillemard 239  
 Guillot 621  
 Gull 63: 279: 526, 539, 623 *a*, 637, 654  
 Günsburg 460  
 Gunz 631  
 Günther 127: 602, 668  
 Gurlt 1, 5  
 Gussenbauer 67, 174: 513: 562  
 Gusserow 552  
 Gutknecht 621  
 Guttman 613  
  
 Haab 204: 564, 625, 641  
 Haberkorn 185  
 Habershon 498  
 Hadden 625, 628  
 Hadlich 633, 638  
 Haeckel 348: 637  
 Hahn 623 *b*, 625  
 Haffter 178  
 Haight 371, 383  
 Halford 262  
 Hall 391: 635  
 Haller 3, 94  
 Hallier 185, 186, 218  
 Hallopeau 637  
 Hallwachs 115  
 Hamilton 27, 96, 108, 120: 255, 259, 266,

*(The numbers refer to the articles.)*

- 324, 498: 528, 579, 582, 589, 596, 606,  
 613, 625, 647, 659  
 Hamlet 190  
 Hammerich 439  
 Hammond 659  
 Hänel 631  
 Hanot 498  
 Hardy 397  
 Hare 517  
 Harley 623 *a*  
 v. Harlingen 367  
 Harms 127  
 Harris, 600, 631, 637  
 Harrison 561  
 Hart 258  
 Hartdegen 650  
 Hartig 220  
 Härtig 619  
 Hartmann 567, 656  
 Harvouet 634  
 Hasse 180: 658  
 Hauff 574  
 Hauser 460  
 Haward 622  
 Hayem 35: 252, 260, 261, 498: 646, 654,  
 658, 659, 667  
 Heath 622  
 Hebra 152: 359, 364, 377, 388, 392, 397,  
 401, 406, 412: 567  
 Hecker 565, 607, 621  
 Hedenius 623 *b*  
 Hegar 115  
 Heidenhain 108, 115: 520, 523  
 Heimer 620  
 Hein 240  
 Heinemann 495  
 Heine 94  
 Heineke 631  
 Heinze 572, 573  
 Heitler 604  
 Heitsch 602  
 Heller 226, 229, 233, 243: 315, 396: 518,  
 531, 552, 582, 592, 662, 663  
 Henle 94: 625, 639  
 Henning 62  
 Henoch 631  
 Hensen 668  
 Heppel 61  
 Hering 27, 97, 120  
 Hermann 52: 525, 625, 627  
 Hertwig 89: 348  
 Hertz 517, 551, 587, 591, 594  
 Herz 667, 668  
 Heschl 59, 178: 305, 491: 604, 622  
 Hess 638, 640  
 Hesse 600, 619, 630  
 Heubner 130: 295, 425, 444: 628, 661  
 Heusinger 8  
 Hewett 631  
 Heydenreich 207: 630  
 Hickmann 11  
 Hildebrand 552, 621  
 Hill 31: 625, 627  
 Hiller 191, 197, 201, 223, 226, 233: 607,  
 613  
 Hillis 392  
 Hilton 632  
 Hindenlang 268, 334  
 Hink 135: 618  
 Hintzen 500  
 Hippocrates 433  
 Hirsch 125, 146: 434, 495: 623 *a*, 669  
 Hirt 600  
 His 623 *b*, 668  
 Hitchcock 670  
 Hitzig 625  
 Hjelt 514: 667, 668  
 Hlava 490: 595  
 Hobson 261  
 Hodgkin 328, 344  
 Hoffa 526  
 Hoffman F. A. 94, 96  
 Hoffmann 492: 518, 531, 550, 662  
 Hofmeier 539  
 Hoggan 667, 669  
 Hollis 639  
 Holmes 308, 632  
 Holsti 526, 539  
 Homén 626, 646  
 Hopmann 568  
 Hoppe-Seyler 52, 96, 191: 258, 259, 262,  
 509  
 Horsley 623 *a*, 667  
 Hortolés 523, 539, 540  
 Horwath 190  
 Hosch 625, 641  
 Houston 13  
 Howits 607  
 Huber 153, 162, 206, 247: 550, 556, 565  
 Hubner 277, 295  
 Hubl 358  
 Hueter 11, 204  
 Huguenin 613, 622, 625, 626, 631, 637,  
 641, 652, 653, 654, 660, 664  
 Hulke 437  
 Humbert 343  
 Humphreys 650, 659  
 Humphry 253, 437: 585, 632  
 Hunter 94  
 Huppert 533, 567, 630, 633, 640  
 Hutchinson 400, 402, 441  
 Hutinel 607  
 Immermann 28  
 Inglessis 535  
 v. Ins 334: 600  
 Isartier 646  
 Israel 134, 135: 279, 292, 299, 436: 522,  
 528, 539, 543, 618  
 Iwanowsky 277  
 Jaccoud 293  
 Jackson (Hughlings) 295: 625  
 Jacobi 530, 534, 542  
 Jacobson 266  
 Jäderholm, 633, 647  
 Jahn 292: 576, 638  
 v. Jaksch 661  
 Jamieson 376  
 Jarisch 392

(The numbers refer to the articles.)

- Jastrowitz 625, 638, 639  
 Jehn 28: 589  
 Jendrassik 651  
 Jenner 594  
 Jensen 3: 633  
 Jeffroy 572, 669  
 Johne 35: 612  
 Johnson 279: 523, 526, 536, 539  
 Johnston 514  
 Jolly 266: 630, 635, 645, 650, 658  
 Joubert 188  
 Julliard 10: 623 *a*, 661  
 Junge 288  
 Jürgens 29  
 Jürgensen 265, 453: 542, 582, 602, 603, 604, 605, 612, 637  
 Kahler 625, 626, 633, 644, 646, 647, 648, 650  
 Kammerer 658  
 Kannenberg 249: 542, 620  
 Kaposi 152: 359, 364, 365, 366, 376, 377, 378, 380, 383, 384, 392, 396, 397, 399, 400, 402, 406, 407, 410, 411: 567  
 Karl Theodor 639, 659  
 Kassowitz 87, 88  
 Kaufmann 219: 621, 622  
 Keating 204  
 Keber 204  
 Kekulé 58  
 Kellermann 641  
 Kelsch 262, 334, 502: 539, 540  
 Ker 479  
 Kern 186  
 Kessler 18  
 Kesteven 637  
 Key (Axel) 79, 99: 460: 583, 628, 645, 666, 670  
 Kidd (Percy) 613, 669  
 Kiener 125: 296, 502  
 Kiessling 249  
 Kirchhoff 630  
 Kirkes 528  
 Kirmisson 561  
 Kitt 221  
 Klebs 84, 117, 125, 127, 128, 145, 161, 174, 178, 183, 184, 185, 186, 188, 201, 204, 206, 209, 226, 247, 250: 260, 262, 281, 308, 314, 315, 343, 391, 400, 437, 440, 448, 460, 490, 495, 504, 513, 514, 515: 517, 518, 534, 539, 540, 542, 550, 554, 556, 561, 565, 602, 612, 623 *a*, 630, 633, 634, 642, 656, 658, 662, 663, 665  
 Klein 63, 74, 76, 86, 119, 120, 125, 186, 206, 209, 211: 318, 320, 474: 540, 542, 584, 602, 613, 626, 628, 639  
 Klemensiewicz 97  
 Klemm 669  
 Klenke 440  
 Klob 515  
 Knauff 600  
 Knauth 594  
 Knoll 533  
 Kölner 131: 670  
 Koch 94, 117, 120, 125, 127, 183, 184, 185, 186, 188, 189, 190, 193, 196, 199, 201, 204, 206, 208, 209, 211, 219, 222, 250: 390, 473: 602, 606, 613, 632, 645  
 Kocher 153, 171, 177, 204: 466: 556, 622, 623, 623 *a*  
 Kohlrausch 178  
 Kohn 535  
 Kohts 567, 568  
 Kolaczek 161  
 Kolesnikow 642, 659  
 van der Kolk 626  
 Kölliker 5, 7, 88, 115: 516, 579, 584, 623 *b*, 636, 639, 658, 668  
 Koller 631  
 König 11: 621  
 Kopp 578, 607  
 Koranyi 605  
 Korn 318  
 Körte 460  
 Köster 119, 120, 143, 163, 171, 204: 292, 299, 316, 391: 612, 613  
 Kostjurin 638, 641  
 Kottmann 260  
 Kowalewsky 516  
 Krafft 302  
 Krafft-Ebing 645  
 Kräpelin 637, 656  
 Kratter 623 *a*  
 Kraus 647, 659  
 Krause 564, 567  
 Krauss 471: 637  
 Kraske 89  
 Kremiansky 664  
 Krieger 272  
 Krönlein 11, 77  
 Küchenmeister 221, 226, 246: 575  
 Kühle 572  
 Kühn 556  
 Kühne 58, 69: 639  
 Kundrat 435, 470: 630  
 Kunkel 67, 68, 69: 268, 317  
 Kupffer 516  
 Küss 107  
 Kussmaul 206: 292, 453, 470: 550, 600, 625, 647, 667  
 Küssner 498  
 Küttner 579, 584  
 Kyber 58, 61, 62, 64: 326, 397  
 Laache 258, 261  
 Labbé 399  
 Labordé 266  
 Lachmann 663  
 Laennec 118: 498: 604, 613  
 Lahmann 670  
 Lancereaux 130: 277, 295, 304, 500: 539, 550, 623 *b*, 653, 661, 663, 664, 667  
 Landau 458: 517  
 Landerer 454  
 Landois 625, 627, 635, 667  
 Landouzy 633  
 Landsberger 556  
 Lang 376, 392  
 Lange 659

*(The numbers refer to the articles.)*

- v. Langenbeck 295, 346, 435  
 Langenfeldt 668  
 Langer 364, 396  
 Langhans 61, 67, 68, 82, 115, 119, 120:  
     287, 299, 328, 329, 343, 344, 345, 399:  
     533, 539, 540, 544, 556, 562, 578, 600,  
     619, 637, 659  
 Langley 626, 646  
 Lankester 185  
 Lassar 25, 96: 407: 534, 535, 539  
 Laura 626, 627  
 Laveran 206: 277: 657, 667, 668  
 Laycock 67  
 Lebedeff 9: 530, 534, 535, 630  
 Leber 61, 219, 221: 440: 641  
 Lebert 125, 173, 178: 490, 495: 582, 621,  
     654, 662, 663, 664  
 Lecorché 539  
 Leech 540  
 Leegard 667, 668  
 Lefferts 468, 575  
 Léger 292  
 Legg (Wickham) 28: 490, 498  
 Legros 399  
 Leichtenstern 17: 258, 469, 479: 522, 542  
 Leitz 415: 621  
 Leloir 365, 397  
 Lemcke 526  
 Lenhosseck 633  
 Leopold 140, 179  
 Lépine 261, 314: 542, 604, 625, 647  
 Leroy 582  
 Lesser 262, 315, 383, 457: 530  
 Létievant 667  
 Letzerich 204: 474: 539, 542, 543  
 Leube 194, 206: 260, 263, 453, 460, 470:  
     531, 532  
 Leuckart 225, 226, 228, 231, 233, 234,  
     235, 245, 246, 247, 250  
 Leut 668  
 Lewaschew 299  
 Lewin 53: 367: 574, 600  
 Lewinski 315  
 Lewis 222, 235, 250  
 Lewitzky 490  
 Leyden 262, 281, 284, 288, 490: 526, 539,  
     542, 579, 603, 604, 612, 626, 630, 632,  
     635, 637, 638, 641, 644, 645, 646, 647,  
     648, 650, 659, 663, 669  
 Lichtheim 25, 219, 221: 262: 530, 582,  
     591, 594, 612, 613, 620, 659  
 Lieberkühn 250  
 Liebermann 231  
 Liebermeister 482, 498  
 Liebig 190  
 Liman 531  
 Limen 457  
 Liouville 302  
 Lippe 125  
 Lippl 601, 612  
 Lissauer 647  
 Lister 94, 97, 185, 186, 194  
 Litten 30, 37, 64: 261, 324, 484, 498: 523,  
     526, 527, 528, 529, 532, 535, 537, 539,  
     542, 543, 544, 576, 584, 588, 589  
 Little 18  
 Littré 465  
 Lockwood 9  
 Löffler 189, 201, 219: 618  
 Lomer 564  
 Long 231  
 Longstreth 565  
 Lorenz 271  
 Lösch 314, 515  
 Lotzbeck 439  
 Louis 572  
 Löwe 628, 639  
 Löwenberg 567  
 Löwenfeld 636  
 Löwenthal 646  
 Lowne 1  
 Lubbock 94  
 Lubimoff 63, 120: 642, 656  
 Lucae 161  
 Lucas 18  
 Luchsinger 530  
 Lücke 136, 149, 171, 173, 178, 204: 515:  
     621, 622, 623, 623 a  
 Ludwig 55  
 Lukkowsky 204  
 Luschka 516, 637, 664  
 Lütkenmüller 13  
 Luton 621  
 Luys 641, 656  
 Lyon 259  
 Maas 88, 140, 179, 180: 258, 437, 438:  
     561, 654  
 Macewen 88  
 Mackenzie (Hunter) 613  
 Mackenzie J. 574  
 Mackenzie (Morell) 567, 568, 569, 572,  
     573, 575, 576, 578  
 Mackenzie (Stephen) 361: 530  
 McConnell 231: 495  
 Madelung 621  
 Maennel 631  
 Magendie 266  
 Magnan 650, 656  
 Magitot 441  
 Mahomed 539  
 Maier 152, 156, 161, 163, 204: 261, 271,  
     282, 292, 454, 455, 470: 647, 667  
 Maizel 74  
 Malassez 261  
 Malinverni 630  
 Manfredi 400  
 Mangelsdorf 498  
 Mansell-Moullin 266  
 Manson 235: 315: 620  
 Manz 656  
 Maragliano 206  
 Marcacci 625  
 Marchand 5, 7, 153, 206: 262: 530, 534,  
     535, 539, 556, 565, 604, 618, 625, 632,  
     641, 663, 669  
 Marchiafava 206  
 Marie 651, 659  
 Markwald 542  
 Martin 74, 125, 126: 296: 564, 567, 632

*(The numbers refer to the articles.)*

- Martinache 623  
 Martini 178  
 Martinotti 646  
 Masius 261: 530, 638  
 Massei 572  
 de Massy 358  
 Mathieu 568  
 Matterstock 471  
 Maurer 161  
 Mauriac 437  
 Mauthner 625, 641  
 Mayer 223: 453: 588, 641, 646, 667  
 Maylard 585  
 Mayr 367  
 Mayser 641  
 Meckel 5, 8  
 Méglin 231  
 Meier 136  
 Meinel 600  
 Menche 613  
 Mendel 646, 656  
 Mendelsohn 602  
 Mendelson 525  
 Merkel 600, 633, 639  
 Meschede 633, 638, 656, 662, 663  
 Meyer 288, 292, 297, 474: 654, 662  
 Meynert 625, 627, 633, 639, 640, 656  
 Michaelis 555  
 v. Michalovicz 625  
 Michaud 644  
 Michel 567  
 Mierzejewsky 650, 656  
 Miller 440  
 Miquel 193  
 Minkowski 647  
 Mitchell-Bruce 17  
 Möbius 638  
 Moczutkowsky 207  
 Moeli 647  
 Mögling 528  
 Moinel 567  
 Moleschott 35  
 Mommsen 542  
 v. Monakow 627, 641, 667  
 Monod 18, 149  
 Montegazza 35  
 Monti 570  
 Moore 181: 402, 515: 556  
 Morgan 619  
 Morin 247  
 Morison 400  
 Moritz 667  
 Morris 552, 663  
 Mosler 260, 262, 322, 327, 328: 550, 575  
 Mosso 628, 635  
 Mott (Valentine) 399  
 Moxon 165, 174: 277, 297, 490, 500: 550,  
 635, 650, 661, 663  
 Mücke 296: 613  
 Muhr 631  
 Müller 127, 147, 165, 206, 226: 261, 272,  
 460: 605, 613, 621, 622, 638, 645, 646,  
 663, 669  
 Munk 262, 490: 620, 625, 635  
 Murchison 328, 343, 490, 495: 572, 669  
 Muron 266  
 Murri 530  
 Nägeli 186, 188, 190, 191, 192, 193, 201,  
 204, 209, 211, 223  
 Nasse 668  
 Nassiloff 204  
 Nathan 515  
 Naunyn 246: 253, 490, 504, 638, 667  
 Nauwerck 204: 281, 455: 534, 535, 537  
 539, 540, 542, 544, 606, 612, 614, 620,  
 654, 659  
 Nedopil 437  
 Neelsen 63: 316, 358: 642, 646  
 Negell 550  
 Neisser 117, 131, 204, 206, 248: 262: 530,  
 564  
 Nelaton 399  
 Neligan 437  
 v. Nencki 183, 184, 191, 194, 197: 479  
 Nepveu 204  
 Neubauer 531, 532  
 Neumann 8, 79, 85, 89, 161: 260, 297,  
 317, 359, 363, 364, 376, 383, 397, 406,  
 409, 440: 556, 622, 659, 662, 667, 668  
 Neupauer 631  
 Neureutter 633, 650  
 Newman 517, 523  
 Nicaise 667, 670  
 Nicati 498  
 Nieten 152: 315  
 Niedick 669  
 Niépce 621  
 Nolen 605  
 Noman 490  
 Nonat 637  
 v. Noordens 523  
 Normand 231  
 Nothnagel 470, 479: 589, 604, 625, 635,  
 669  
 Obermeyer 207  
 Obersteiner 625, 628, 635, 638, 640, 645  
 Oellacher 5  
 Oeller 288  
 Oemler 201  
 Oertel 204: 425: 542, 575, 669  
 Oldham 153  
 Ollivier 526  
 Oppenheim 648, 669  
 Ord 531, 623 a  
 Oordt (Van) 128  
 Ormerod 647, 648  
 Orth 1, 8, 13, 69, 114, 125, 127, 204: 271,  
 285, 292, 324, 334, 342, 482, 501: 570,  
 587, 595, 605, 606, 613  
 Osler 556, 630, 662  
 Ossikovszky 490  
 Otto 642, 650  
 Overbeck 525  
 Owen 233  
 Pagenstecher 221: 316: 620, 635  
 Paget 42, 71, 80, 86, 89, 94, 107, 136, 146,

*(The numbers refer to the articles.)*

- 147, 149, 165, 171, 173, 178, 181, 233: 630, 633  
 Pagliani 231  
 Pankritius 607  
 Pansch 625  
 Panum 3, 5, 7, 13, 178, 190, 197: 460: 589, 630  
 Papp 631  
 Parker 619  
 Parona 231  
 Parrot 663  
 Parsons 621  
 Pasteur 183, 186, 188, 191, 201, 206, 209, 223  
 Paulizky 61  
 Paulus 664  
 Pautynski 520, 528  
 Pawlinoff 607  
 Payne 150: 504: 622  
 Peacock 271, 272, 309: 579  
 Pearson 600  
 Penzoldt 260, 261, 453, 454: 565  
 Pepper 514  
 Perchappe 656  
 Perewerseff 556  
 Perl 517  
 Perls 1, 3, 7, 9, 12, 13, 68, 85, 153, 154, 156, 173, 174, 194, 199, 204, 226, 231, 248: 316, 400, 504: 522, 523, 533, 539, 619, 630  
 Perroncito 226, 261  
 Peters 63: 332  
 Peterssen-Borstel 510  
 Petrina 625, 662  
 Petters 315  
 Peyerani 667  
 Pfeiffer 613  
 Pfitzer 308  
 Pfleger 633  
 Pflug 135: 618  
 Philippeau 667, 668  
 Pierret 633, 640, 647, 648  
 Pierson 625, 669  
 Pick 625, 630, 633, 637, 644, 646, 647, 648, 650  
 Pinel 539  
 Pinner 152: 622  
 Pitres 525, 647, 669  
 Platen 539  
 Poels 605  
 Poensgen 453  
 Poland 133  
 Pollack 650  
 Pollard 650  
 Pollender 206  
 Ponfick 81, 114, 135: 260, 261, 262, 266, 268, 302, 314, 322, 328, 349, 436: 530, 534, 539, 542, 618  
 Popoff 498: 659  
 Popow 641, 667  
 Posner 498: 523, 533, 539, 562, 588  
 Pospelow 152  
 Poster 437  
 Potain 343  
 Pouchet 261  
 Poulin 292  
 Pramberger, 579  
 Prazmowski 186, 188  
 Prévost 647  
 Proujeansky 247  
 Prince 513  
 Prior 472  
 Priestly 74  
 Proust 607, 659  
 Prudden 670  
 Puichaud 623  
 Pullar 359: 659  
 Purjesz 602  
 Purtscher 641  
 Putiata 346  
 Putjatin 277  
 Pütz 133: 433: 605, 618  
 Pye-Smith 261  
 Quain 52: 495  
 Quinke 261, 268, 304, 315, 317, 350, 460, 481  
 Quinquaud 261  
 Raab 255, 631  
 Rabe 618  
 Radcliffe 653  
 Ralfe 531  
 Ramdohr 607  
 Ranke 632, 659  
 Ranvier 52, 66, 76, 84, 89, 120, 128, 146, 156: 258, 261, 292, 328, 332, 425, 500: 528, 539, 550, 551, 569, 572, 575, 596, 607, 613, 623, 639, 662, 663, 667, 668  
 Raphael 531  
 Rättig 250  
 Rauber 5  
 Rauchfuss 271: 569, 570, 578  
 Rauschenbach 252  
 Rayer 383: 517, 539, 550  
 Raymond 613, 647  
 Raynaud 204  
 Realì 631  
 Rebsamen 334  
 v. Recklinghausen 63, 99, 154, 205: 349, 392, 397, 398, 399, 439, 453, 511, 514: 595, 645, 650, 670  
 Redfern 87  
 Reess 219: 223: 490  
 Rehn 8: 458  
 Reichel 13, 152  
 Reid 18  
 Reil 271  
 Reinhardt 51: 619  
 Reinke 190  
 Reisinger 637, 662  
 Reiss 490  
 Remak 76, 174, 178: 667, 668  
 Renaut 662  
 Rettelheim 654  
 Retzius 79: 628, 633, 666  
 Reubold 436, 439  
 Reuss 96  
 Reverdin 84: 623 *a*  
 Reynolds 635

*(The numbers refer to the articles.)*

- Rheiner 570  
 Ribbert 520, 521, 522, 533, 539, 540, 542,  
 619, 630  
 Richard 206  
 Richaud 498  
 Richet 625  
 Rickards 536, 556  
 Riedel 255: 628  
 Riegel 577, 579, 594, 613  
 Riehl 574  
 Riess 204: 263  
 Rindfleisch 42, 59, 66, 76, 81, 84, 85, 86,  
 109, 114, 117, 119, 120, 125, 150, 165,  
 173, 174, 204: 261, 296, 388, 502: 530,  
 534, 539, 573, 582, 587, 613, 619, 632,  
 647, 650, 660, 663, 664, 668  
 v. Rinecker 661  
 Ripping 637  
 Rivolta 250  
 Roberts 190, 194: 513: 517, 523, 530, 532,  
 539, 552, 555, 561  
 Roberts J. B. 555  
 Robin 260: 556, 600, 628, 663, 664, 667  
 Robinson 376: 523, 567, 641  
 Roellinger 623  
 Roger 659  
 Rohon 633  
 Rohrer 179: 556  
 Rokitansky 58, 149: 271, 514: 539, 578,  
 585, 604, 619, 621, 637, 650, 663, 664  
 Röll 623 a  
 Rollet 517  
 Romelaere 591  
 Rose 577, 622  
 Rosenbach 194: 262, 284, 453: 669  
 Rosenberger 115, 196, 211  
 Rosenstein 517, 526, 539, 550, 620  
 Rosenthal 661  
 Ross 383: 625, 626, 627, 628, 630, 635,  
 641, 647, 669  
 Rossbach 196: 579  
 Rószahgyi 201  
 Roth 9: 302, 304, 305, 464, 510: 574, 628,  
 636, 638, 662, 669  
 Rottenstein 440  
 Rouis 495  
 Roustan 125  
 Rovida 533  
 Roy 279, 318: 521  
 Ruboni 513  
 Rudneff 58  
 Rühle 612, 613  
 Rumler 143  
 Rumpf 639, 650  
 Runeberg 520, 523  
 Runge 605  
 Ruppert 266: 600  
 Rütimeyer 648  
 Russell 361  
 Rustizky 664  
 Ryneck 97  
 Sabourin 498: 556  
 Saccharjin 607  
 Sachs 212, 215, 218, 220, 223: 625  
 Sahli 659  
 Sakaky 648  
 Salkowski 191, 197: 479, 490: 531, 532,  
 579  
 Salter 441  
 Salvioni 260, 318, 498: 602, 639  
 Samuel 80, 94, 95, 96, 97: 539  
 Samuelsohn 641  
 Samuelson 277  
 Sander 630, 633, 641  
 Sanders 259  
 Sanderson (Burdon) 94, 95, 99, 119, 120,  
 225, 183, 186, 189: 328: 625, 653  
 Sanquirico 623 a  
 Sansom 282  
 Santi Sirena 667  
 Sattler 163  
 Saundby 533, 539, 565  
 Savage 637  
 Sawyer 517  
 Säxinger 552  
 Schachowa 535  
 Schäfer 261  
 Schäffer 612  
 Schatz 562  
 Schech 574  
 Schede 8, 180  
 Scheiber 367  
 Scherer 259  
 Scheube 669  
 Schiefferdecker 626, 638, 646  
 Schiff 623 a, 667, 668  
 Schklarewsky 27, 96  
 Schlesinger 636, 637  
 Schlossberger 531  
 Schmidt 35: 252, 261, 485, 498: 600, 631  
 Schmidlein 550  
 Schmidt-Rimpler 641  
 Schmiedeberg 191, 197  
 Schnitzler 607  
 Schopfhagen 637, 659  
 Schön 668  
 Schönlein 409  
 Schott 654  
 Schotte 190  
 Schottelius 570, 576, 577, 600, 601, 612,  
 619  
 Schreiner 260  
 Schroeter 191  
 Schroetter 575, 578  
 Schrön 171  
 Schuberg 479: 664  
 Schuchardt 526  
 Schuchart 591  
 Schüle 630, 650, 656  
 Schüller 132  
 v. Schulthess-Rechberg 277  
 Schultz 255, 256, 308  
 Schultze 5: 252: 531, 626, 633, 637, 646,  
 647, 648, 651, 656, 659, 662, 667  
 Schultzen 490  
 Schulz 52: 344, 358, 490: 647  
 Schulze 54  
 Schüppel 119, 120, 127: 342, 491, 500,  
 504, 510, 512: 605, 637, 662, 664

*(The numbers refer to the articles.)*

- Schülte 491  
 Schütz 539, 607, 618  
 Schützenberger, 223  
 Schwalbe 625, 626, 627, 628, 639  
 Schwärck 470  
 Schweigger 288  
 Schweninger 84, 125: 425: 601, 612  
 Schwimmer 437  
 Scoda 633  
 Scott 531  
 Scriba 266  
 Sedgwick 516  
 Sée (Germain) 613  
 Seegen 612  
 Seguin 625  
 Seitz 472  
 Seligsohn 600  
 Selvili 656  
 Semmer 196, 201, 204, 299  
 Semmola 539  
 Semper 516  
 Senator 278: 523, 531, 539, 542  
 Senftleben 108, 115: 255  
 Senger 602  
 Senise 612  
 Sermani 613  
 Shepherd 606  
 Shuttleworth 633  
 v. Siebold 225: 551  
 Sigel 612  
 Siemens 651  
 Silbermann 605  
 Simmerling 648  
 Simon 94, 125, 174: 400: 551, 552, 578,  
 633, 637, 656  
 Simon 646  
 Simons 498  
 Simpson 14  
 Singer 626  
 Skwortzoff 625  
 Slavjansky 266: 600  
 Smith 154: 523, 542, 556, 600, 626, 628,  
 639  
 Smith (Everett) 648  
 Socoloff 320: 579  
 Sokolow 156  
 Solly 647  
 Sommerbrodt 574, 596  
 Sonderegger 241  
 Sonnenberg 13  
 Sossino 239  
 Southey 550  
 Soyka 154, 193: 266, 334, 600  
 Spaet 663  
 Spatz 272  
 Spear 206  
 Spengel 516  
 Sperling 630, 664  
 Spiegelberg 458: 621  
 Spilling 260  
 Spring 631  
 Stadelmann 647  
 Stadfeldt 552  
 Staudenmeyer, 623  
 Steffen 504, 631  
 Stein 266: 562  
 Steiner 471: 570, 633, 650  
 Steinrück 668  
 Steinthal 550, 561  
 Sternberg 194, 204, 206: 564, 602  
 Steudener 88, 156: 570, 578, 623 b, 659  
 Steven 543  
 Stewart 648, 656  
 Stewart (Grainger) 537, 539, 669  
 St. Hilaire (Geoffroy) 3, 5, 7: 630, 631  
 Stieda 250: 623 b, 639  
 Stilling 94: 315: 619: 627  
 Stirling 625, 627  
 St. Lager 623 a  
 Stoffela, 647  
 Stöhr 442  
 Störck 578  
 Strasburger 74, 75, 76, 84  
 Strauss 537  
 Streckeisen 621  
 Strelzoff 88  
 Stricker 79, 86, 95, 99  
 Stroganow 292, 380  
 Stromeyer 621, 658  
 Struck 208  
 Strümpell 515: 637, 647, 648, 651, 653,  
 659, 669  
 Struthers 17  
 Sturge 659  
 Sturges 604  
 Sturm, 556  
 Suchard 205  
 Surre 498  
 Sussdorf 605  
 Sutton 63: 279: 526, 539  
 Szymanowski 631  
 Talko 631  
 Takacs 647  
 Talma 292: 528  
 Tappeiner 125: 262: 601, 602  
 Taruffi 271  
 Tautain 277  
 Taylor 261, 457, 490: 637  
 Teppel 327  
 Teuffel 498, 512  
 Thierfelder 358, 490, 495, 498: 594  
 Thiersch 109, 171, 181: 402  
 Thin 367, 380, 392, 400, 402, 407: 574  
 Thoma 95, 96, 97, 131: 258, 261, 272,  
 288, 392, 467: 522, 526, 539  
 Thomas 206: 533, 534, 542, 603, 604,  
 623 b  
 Thomson 600  
 Thomson (Allen) 516  
 Thorn 551  
 Thorspecken 453  
 Thudichum 568  
 Tiegel 185  
 v. Tieghem 185, 186, 189  
 Tiesler 669  
 Tiffany 607  
 Tigges 656  
 Tillmanns 5, 11, 85, 108, 109, 115, 204:  
 285: 667

*(The numbers refer to the articles.)*

- Tills 85  
 Tizzoni 204, 206: 261, 317, 492: 623 *a*,  
     667  
 Tobbold 572  
 Toldt 665  
 Tommasi-Crudeli 204, 206  
 Tornwaldt 567  
 Tournoux 632  
 Toussaint 201, 206  
 Touton 371  
 Toynbee 654  
 Traube 101: 279, 495: 523, 526, 539, 591,  
     596, 600, 601  
 Travers 86  
 Trélat 18  
 Trendelenburg 204  
 Treub 669  
 Treves 120: 342  
 Tripier 625  
 Trojanowsky 582  
 Trompetter 292  
 Tschirjew 659  
 Troussseau 261, 328, 344, 572  
 Tuczek 648, 656  
 Tüngel 633  
 Türk 569, 574, 576, 578, 626, 627, 646,  
     647, 656  
 Turner 17, 62: 277, 315, 633, 639, 659  
 Tyndall 193  
  
 Ungar 579  
 Unna 128: 371, 385, 388, 404  
 Unruh 542  
 Urlichs 209  
 Uskoff 440  
 Uskow 277  
 Utthoff 528  
  
 Vacca 95  
 Vacher 204  
 Vaillard 346: 669  
 Vallat 332  
 Vallienne 11  
 Valsuani 11  
 Vandyke Carter 222  
 Vanlair 261: 638, 667, 668  
 Variot 437  
 v. Velden 657  
 Veraguth 596, 601, 612  
 Verneuil 13, 154: 402  
 Verriers 605  
 Veyssière 625  
 Vierling, 578, 607  
 Vierordt 579, 633, 647, 669  
 Villaret 600  
 Villemin 125, 133: 594  
 Virchow 5, 8, 13, 14, 30, 35, 48, 56, 58,  
     61, 62, 68, 72, 76, 77, 78, 80, 81, 84,  
     85, 87, 89, 90, 94, 114, 117, 118, 125,  
     127, 128, 131, 136, 138, 145, 146, 147,  
     149, 150, 152, 153, 154, 156, 165, 171,  
     177, 179, 201, 221, 233, 247: 252, 260,  
     272, 287, 299, 305, 314, 326, 328, 332,  
     334, 343, 344, 392, 399, 400, 425, 437,  
     438, 439, 441, 457, 460, 483, 495, 500,  
     514: 530, 531, 539, 544, 550, 551, 552,  
     556, 561, 565, 568, 570, 574, 577, 587,  
     589, 600, 607, 619, 621, 622, 623, 623 *a*,  
     623 *b*, 628, 631, 632, 633, 634, 636, 637,  
     648, 650, 658, 660, 661, 662, 664, 669,  
     670  
 Vogel 94: 437: 531, 532  
 Vogt 179, 633  
 Voigt 10  
 Voisin 561, 656  
 Voit 52, 191, 201: 485, 490: 531  
 Volkmann 562, 567, 577  
 Vrolik 1  
 Vulpian 641, 647, 667, 668  
  
 Wagner 56, 59, 62, 120, 128, 129, 206:  
     316, 327, 358, 383, 425, 436, 470, 491,  
     498, 500, 515: 526, 534, 539, 542, 570,  
     596, 602, 604, 607, 619, 623 *a*, 633, 661  
 Wagstaffe 532  
 v. Wahl 453: 612  
 Waldenburg 118, 125, 250  
 Walder 206  
 Waldeyer 84, 161, 171, 173, 178, 204, 206:  
     260, 316, 358, 490, 504: 556  
 Waldstein 247: 261  
 Waller 96: 646, 667, 668  
 Waller B. C. 540  
 Wallis 99  
 Wardell 222  
 Wargunin 612  
 Warren 399, 402  
 Wartman 87  
 Wasserthal 13  
 Watney 623 *b*  
 Webber 669  
 Weber 86, 125: 437, 438, 500: 591, 664  
 Weddel 613  
 Wedl 9: 440: 642  
 Wegner 115, 120, 152: 315, 437, 438, 490  
 Weichselbaum 556, 567, 600, 601, 612,  
     619, 665  
 Weidner 383  
 Weigert 13, 36, 96, 123, 179, 204, 207:  
     288, 296, 314, 324, 371, 388, 425, 504:  
     518, 528, 533, 534, 535, 536, 539, 542,  
     556, 570, 613, 623, 653, 665  
 Weil 174: 577, 579  
 Weir 437  
 Weir-Mitchell 667, 668  
 Weiss 639, 647, 650  
 Weissgerber 194: 523, 533, 539  
 Welander 564  
 Welch 588  
 Welcker 17  
 Weller 659  
 Wendt 161, 233  
 Werner 618  
 Wernich 193, 201, 209, 211: 474  
 Wernicke 625, 627, 644  
 v. Werra 528  
 Wesener 515  
 West 631  
 Westphal 625, 629, 633, 637, 646, 647,  
     648, 650, 656, 657, 659, 661

*(The numbers refer to the articles.)*

- Wever 327  
Weyl 400  
Whipham 536, 637  
Whistler 574  
White 623 *a*, 637  
Whitehead 470  
Whitley 500  
Wiederhöfer 453, 458  
Wieger 63: 332: 638  
Wienkowski 315  
Wiktorowsky 460  
Wilbrand 625  
Wille 630, 633  
Wilks 165, 181: 261, 277, 297, 321, 328,  
491, 500: 539, 660, 661, 663, 664  
Williams 96, 153: 556  
Willigk 589  
Wilson 125  
Wilson (Erasmus) 408  
Windle 535, 556  
*v.* Winiwarter 97, 117: 292, 343, 346,  
438, 490: 622  
Winkel 262  
Winogradow 318  
Winternitz 367  
Winslow 3  
Witkowski 637, 645  
Wittich 250: 623 *b*  
Wolberg, 667, 668  
Wolf 565  
Wolfenden 659  
Wolff 88, 177, 197, 201, 204, 209: 647  
Wolffhügel 189, 190  
Wölfler 471: 517, 621, 622, 623  
Wood 204  
Woodhead (Sims) 436: 647  
Woodward 470  
Wooldridge 35  
Worms 647  
Wucherer 231  
Wulff 504  
Wunderlich 343: 653  
*v.* Wyss 84, 108, 125, 206: 383, 490, 498,  
514: 613, 654  
Yeo (Burney) 125  
Yeo (Gerald) 625  
Youatt 133  
Zacher 633, 637, 651, 656  
Zaeslein 261: 602  
Zahn 61, 140, 179: 252, 261, 425, 482:  
595  
Zander 279  
Zangger 206  
Zenker 38, 153, 222, 229, 233, 243: 260,  
261, 304, 449, 490, 498, 513: 579, 587,  
600, 636, 637, 638, 650, 653, 663, 664,  
665  
Zesas 623 *a*  
Ziegler 28, 37, 59, 61, 68, 85, 86, 88, 108,  
109, 110, 115, 119, 120, 123, 140, 145,  
150, 156, 173, 174, 179, 184, 193, 204:  
255, 268, 277, 281, 288, 375, 376, 388,  
437, 444: 526, 539, 575, 600, 604, 612,  
613, 628, 631, 633, 637, 648, 658, 663  
Ziehl 602, 613  
*v.* Ziemssen 449, 460: 569, 570, 573, 574,  
575, 576, 653  
Zuckermandl 567, 568, 584  
Zülzer 204  
Zunder 490  
Zürn 226: 575

# INDEX OF SUBJECTS.

*(The numbers refer to the articles.)*

- abnormalities of the heart 270 sqq  
     of the kidney 517 sqq  
     (see malformations)
- abrachius 10
- abscess 102, 116  
     alveolar 440  
     bronchopneumonic 611  
     lung 605  
     metastatic 116  
     of brain 653, 654  
     of kidney 543  
     of liver 493 sqq  
     of œsophagus 450  
     perinephritic 543, 554  
     spleen 322, 324  
     stomach 457  
     tonsils 442  
     tuberculous 428
- absorption by peritoneum 349  
     of serous effusion 352
- acardiacus 13
- acarus folliculorum 225  
     scabiei 225, 413
- accessory lobes of lung 585  
     suprarenals 565  
     thymus glands 623 b  
     thyroid glands 621
- achirus 10
- achorion Schönleinii 222, 410
- achroma 365
- acids, corrosion by 450, 457
- acne 405  
     albida 404  
     mentagra 405  
     rosacea 360  
     sebacea 403
- acrania 7, 620
- actinomyces 222
- actinomycosis 134, 135, 222, 436  
     of lung 618
- acute miliary tuberculosis 123  
     atrophy of the liver 204
- Addison's disease 362, 565
- adenia 328, 344
- adenocarcinoma 169, 173, 431, 462, 478,  
     512
- adenoma 166, 167 sqq  
     false 422  
     of intestine 478  
     of liver 502  
     of mucous membrane 431  
     of sweat-glands 402  
     of thyroid, 631
- adhesive inflammations 352
- adipose tissue, growth of 85
- adiposity 50
- æcidium elatinum 220
- ægagropili 479
- aërobious fungi 188, 206
- ætiology of goitre 623 a
- agenesis of brain 630
- agnathia 8
- agrotis segetum 222
- ague-cake 321
- air, bacteria in the 193  
     in blood 265, 266
- air-passages, structure of 566
- albinism 365
- albumen, excretion of 520
- albuminuria 523, 528, 533, 538 sqq
- albuminoids, putrefaction of 191, 192
- alcoholic fermentation 212  
     fermentation set up by mu-  
         cor 219  
     fermentation set up by yeasts  
         223
- algæ 212
- alimentary tract Sect. VII. (Part II.)
- alkalies, corrosion by 450, 457
- allantois 516
- alopecia 407
- alternation in mould-fungi 218
- aluminosis 600
- alveolar abscess 440  
     colloid 247  
     colloid of liver 507  
     ducts 584  
     sarcoma 161
- alveoli of lung 584
- amelus 10
- amoeba coli 250  
     rotatoria 250
- amputation, intrauterine 10  
     nerve-changes after 641
- amputational neuroma 154, 668
- amyelia 630
- amyloid change of bladder 561  
     change of heart 275  
     change of kidney 537  
     change of liver 491  
     change of lung 595  
     change of lymphatic glands  
         332  
     change of mucous membrane  
         417  
     change of spleen 325

(The numbers refer to the articles.)

- amyloid change of thyroid 623  
   change of vessels 288  
   concretions 61  
   degeneration 57 sqq  
   degeneration, results of 60  
   degeneration, seat of 59, 62  
   substance, nature of 59, 62  
   substance, reactions of 58  
 amyotrophy 640  
 amyotrophic lateral sclerosis 647  
 anæmia 19, 258, 261  
   of brain 635  
   of kidney 524  
   of liver 483  
   of lung 586  
   collateral 22  
 anæmic necrosis 40  
   necrosis from atheroma 300  
 anaërobus fungi 188  
 anasarca 23  
   in nephritis 539  
 anastomotic aneurysm 151, 289, 301  
   varix 151  
 anchylostoma duodenale 231, 479  
 anencephalia, 7, 630  
 Aneurysm 301 sqq  
   of basilar arteries 663  
   dissecting 309  
   false 308  
   miliary 636  
   of heart 284  
 aneurysmal varix 301, 311  
 angina 442  
   Ludovici 447  
 angiolithic sarcoma 663  
 angioma 148, 312  
   congenital 179  
   lymphatic 152  
   of brain 663  
   of liver 504  
   of mouth 438  
   of skin 401  
 angiosarcoma, myxomatodes 163  
   plexiform 161  
 anguillula stercoralis (rhabditis) 231  
 angular gyrus 624  
 anhydræmia 258  
 annectant convolutions 624  
 anomaly, congenital 1  
 anthracosis 600  
 anthrax (see bacillus anthracis) 199  
   genesis of 206  
   history of 206  
   intestinal 477  
   simplex 405  
   specific 390  
   symptomatic 206  
   vaccination in 201  
 antheridium 218  
 anus, imperforate 464  
 aorta, aneurysm of 303  
   degeneration of 287  
   inflammation of 292  
   primitive 270  
 aortic bulb 270, 271  
 aortitis, acute 292  
 apex of lung in phthisis 616  
 aphasia 625  
 aphemia 625  
 aphtæ 433  
 aphtous stomatitis 433  
 aplasia of the limbs 10  
   of the brain 630, 633, 641  
 apneumotosis 591  
 apoplexy 27, 304  
   cerebral 636  
   pancreatic 513  
   pulmonary 586  
 aprosopia 8  
 apus 10  
 arachnoid 628  
 arachnida 225  
 arachnitis 656  
 archenteron 348  
 area Celsi 407  
 argyria 362  
 argyrim 70  
 argyrosis of kidney 530  
 archinencephalia 630  
 arsenic, causing fatty change 52  
 arterial trunks, defect of 271  
   hæmatoma 308  
 arteries, syphilis in 130  
 arterio-capillary fibrosis 279, 526  
 arterioles, hyaline change in 288  
 arterio-sclerotic kidney 525, 526  
 arteritis 291, 292  
   deformans 299  
   syphilitic 295  
 arthropoda 225 sqq  
 ascaris lumbricoides 228, 479  
   mystax 228, 479  
 ascending degeneration of cord 646  
 ascites 23, 350, 497  
   chylous 31  
 ascococcus 185  
 ascogonium 216  
 ascopore 213, 216  
 ascus 216  
 aspergillus glaucus 216, 221  
   flavescens etc. 219, 222  
 asteatosis 403  
 ataxy, locomotor 647  
 atelectasis of lung 591  
 atheroma causing aneurysm 302  
   of endocardium 276  
   of vessels 288, 297 sqq  
   (sebaceous) 404  
 atheromata (congenital) 8  
 atheromatous ulcer 297  
 atresia ani 464  
   of great vessels 271  
   of intestine 468  
   urethræ 519  
 atrophic pigmentary induration of  
   stomach 456  
   cirrhosis of liver 498  
   proliferation 46  
 atrophy, active 47  
   in mouth 437

(The numbers refer to the articles.)

- atrophy, of inaction 47
  - of anterior horns 640
  - of brain 638, 640
  - of cerebrum 640
  - of cerebellum 640
  - of cord 640
  - of heart 273
  - of intestine 468, 470
  - of kidney (congenital) 517, (anæmic) 525
  - of liver 483, 485 sqq
  - of liver, acute yellow 489, 490
  - of lymphatic glands 331
  - of mucous membrane 417
  - of nerves 667
  - passive 47
  - pigmentary 45, 46
  - serous 46
  - simple 43, 45
  - of spleen 325
  - of stomach 455
  - trophoneurotic 47
  - of vessels 288
- attenuation of virus 201, 211
- attraction theory of inflammation 94
- autochthonous thrombus 253
- autosite 13
- axis-cylinder 666, 667
- of anthrax 390
    - of typhoid 474
- of glands 618
      - of typhoid 206
      - of tubercle in glands 342, 613
      - of tubercle in lung 606, 613
      - of tubercle in sputum 613
      - of tubercle in vessels 296
    - tuberculosis 120, 127, 186, 206 (Fig. 80)
    - detection of 127
- bacon liver 57, 491
- spleen 325
- bacteria 183 sqq
  - biology of 188 sqq
  - in air, soil, etc. 193
  - in catarrh 420 (see bacilli, micrococci)
  - classification of 183
  - diffusion of 193
  - effect of agitation on 190
  - effect of heat on 189
  - effect of light on 190
  - effect of poisons on 190
  - effect on nutrient liquid 191
  - in endocarditis 281
  - in erysipelas 375
  - in hepatic abscess 494
  - inflammation excited by 198, 199
  - in health 194
  - in kidney 529, 543
  - in intestine 479
  - in leprosy 392
  - in lymphatic glands 335
  - mutability of 192, 208, 209, 211
  - non-pathogenous 197
  - pathogenous 195, 196, 198
  - in pemphigus 384
  - in phlegmon 390
  - in purpura hæmorrhagica 361
  - in smallpox 388
  - specific nature of 208, 209
  - in splenic abscess 322, 324
  - in stomach 453
  - in syphilis 391
  - textural changes caused by 200.
  - in urine 558
- bacterial action, theories of 210
- bacterium decalvans 407
  - lineola 185, 205
  - subtile 211
  - termo 185, 189, 192, 205
- balantidium coli 250
- baldness 407
- barber's itch 411
- Basedow's disease 623 a
- bed-bug 226
- bed-sores 33
  - gangrenous 390
- belladonna-rash 367
- beriberi 669
- bezoars 479
- bile in blood 259, 268
- bile-ducts, cancer of 508
  - inflammations, etc. of 508: sqq
  - new-formed 497
- bile-pigments 69, 481
  - in gall-stones 508, 509
- bilharzia hæmatobia 239
  - in blood 265
  - in kidney 557
- biliary abscess 493, 495
  - colic 510
  - concretions 508 sqq
  - hepatitis 498
  - infiltration of kidney 530
- bilirubin 268
  - in gall-stones 508, 509
- biliverdin in gall-stones 508, 509
- bird's-nest body 172
- bladder, development of 516
  - dilatation of 563
  - disorders of 558
  - malformations of 519
  - tumors of 562
- blastomycetis 223 sqq
- blebs 370
- bleeders 28
- blisters 370, 371, 373, 381
- blood, a tissue 251

(The numbers refer to the articles.)

- blood, air in 265, 266  
 -casts in urine 558  
 changes in 258 sqq  
 coagulation of 252  
 composition of 251, 258  
 -corpuscles, changes in 260 sqq  
 hyperplasia of 258  
 impurities in 263 sqq  
 parasites in 265, 266  
 -pigments 68  
 -plates 252, 261, 263  
 -vessels, growth of new 86  
 -vessels in tabes dorsalis 648  
 -vessels, wounds of 256 (see vessels)  
 blood and lymph Sect. I. (Part II.)  
 and lymph, functions of 251  
 bloody sweat 361  
*Blutplättchen* 35, 252, 261, 263  
 body-cavity, development of 348  
 boils 405  
 bones, growth of 88  
   metaplasia of 91  
   regeneration of 88  
 bothriocephalus cordatus 240  
   cristatus 249  
   latus 249, 479  
 botrytis bassiana 222  
 'bots' 226  
 bovine tuberculosis 127, 206  
 Bowman's capsule 516, 520  
 brain-disease, lymphatics in 269  
 brain, anæmia of 635  
   atrophy of 638, 640  
   compression of 644  
   concussion of 645  
   contusion of 645  
   degeneration of 638  
   disorders of 629 sqq  
   histology of 639  
   hyperæmia of 635  
   hypertrophy of 633, 651  
   inflammations of 652 sqq  
   malformations of 630 sqq  
   membranes of 628  
   parasites of 66 sqq  
   sclerosis of 649, 650, 651  
   softening of 639, 642  
   structure of 624 sqq, 639  
   syphilis of 661  
   tuberculosis of 660  
   tumors of 662  
   vessels of 628  
   wounds of 658  
 bridge-building, paralysis in 645  
 Bright's disease 539  
   disease and cardiac hyper-  
     trophy 279  
   disease and vascular hyper-  
     trophy 289  
 bronchi, disorders of 579 sqq  
 bronchial vessels 584  
   glands, tuberculosis of 613  
 bronchiectasis 579, 582, 583  
 bronchiole 584  
 bronchiolitis, exudative 579  
 bronchitis 579  
 bronchoblennorrhœa 579  
 bronchocele 621  
 bronchopneumonia 596, 599, 610 sqq  
 bronchorrhœa 579  
 bronzed skin 362, 565  
 bronzing 67  
 brood-capsules (ecchinococcus) 245  
 brood-cells 76  
 brown atrophy of heart 273  
   induration of lung 587  
 bubo 391  
   hard syphilitic 342  
   suppurating 337  
 bulbar nuclei, atrophy of 640  
   paralysis 647, 659  
 bullæ (see blebs and blisters)  
 bullous emphysema 594  
 Burdach, columns of 626  
 burn, blisters from 370, 372, 381  
 burns, effect on blood 262  
 cachexia of tumor 141  
   strumipriva 623 a  
 cadaveric poison 197, 390  
 caisson-paralysis 645  
 calcaneus (talipes) 11  
 calcareous deposits 64, 65  
   deposits in bile-ducts 508 sqq  
   deposits in kidney 532  
   deposits in pancreatic ducts  
     514  
   deposits in thyroid 623  
   deposits in vessels 288  
   calculi 532, 560  
 calcarine fissure 624  
 calcification, after necrosis 34  
   of lymphatic glands 338  
   of brain 638  
   of thrombi 254  
   of vessels 288, 297  
 calculi, biliary 508 sqq  
   intestinal 479  
   pancreatic 514  
 calculous pyelitis 555  
 calculus, salivary 448  
   vesical 560  
   urinary 560  
 callosities 394  
 canal of Wirsung 513  
 canalization of thrombus 255  
 canals, biliary 480  
 cancellous osteoma 147  
 cancer-cells 170  
 cancer, endothelial 316, 358, 663, 664  
   (see carcinoma)  
   of lymphatic glands 347  
   of serous cavities 358  
   of skin 402  
   stroma 170  
 cancrroid 402  
   dry 404  
 cancrum oris 434  
 canities 365

(The numbers refer to the articles.)

- canker in cattle 135
- cantharides, blisters from 381
  - gastric ulcer from 459
  - cystitis from 561
- capillary aneurysms 305
  - ectasis 305
- capillaries, growth of 86
- capsule of Bowman 516, 520
  - of Glisson 480
  - internal 625 (Fig. 245)
  - external 625 (Fig. 245)
- caput medusæ 497
- carbonic acid poisoning 259
- carbonic oxide poisoning 259
- carbuncle 405
- carcinoma 166, 170 sqq
  - ætiology of 181
  - growth of 171
  - of intestine 478 (see cancer)
  - of liver 503
  - of meninges 663, 664
  - metastases in 174
  - of mucous membrane 431
  - of œsophagus 451
  - of pancreas 515
  - of serous membrane 358
  - of skin 402
  - of stomach 461, 462
  - varieties of 173
- cardiac ganglia, changes in 277
  - hypertrophy and renal disease 279
  - hypoplasia 272
  - malformations 271
  - polypus 253, 277
  - thrombosis 253
- caries of teeth 440
- carnification of lung 592, 604
- carpogonium 216
- carrier-cells 114
- cartilage, growth of 87
  - laryngeal, disease of 576
  - metaplasia of 91
- caruncle 564
- caseation 39
  - after necrosis 34
  - in tubercle 118
  - of lung 598
  - of lymphatic glands 332, 333, 342
- casts in urine 523, 533, 558
- caseous pneumonia 606
  - necrosis of lung 611
- catarrh 55
  - desquamative 103
  - purulent 102
  - serous 102
  - of intestine 470
  - of larynx 570
  - of lung 597
  - of mucous membrane 420, 421
  - of nose 567
  - of œsophagus 450
  - of stomach 456
- catarrhal stomatitis 433
- cavernous angioma 150
  - angioma of liver 504
  - metamorphosis 150
- caudate nucleus 625
- cauliflower excrescences 564, 575
- cavities in lung (see vomica, bronchiectasis) 616
- cebocephalia 630
- cells, division of 74, 75
  - multiplication of 80, 81
- cell-nests 170, 172
- cellulitis 390
  - micrococci in 204
  - pelvic 669
- central fissure of cerebrum 624
  - lobe of cerebrum 624
  - nervous system Sect. IX. (Part II.)
  - red atrophy of liver 483
- centrum ovale 625
- cephalocele 631
- cercaria 236, 239
- cercomonas 250
  - in lung 620
  - intestinalis 479
- cerebellum 624, 627
- cerebellar tract 626
  - atrophy 640
- cerebral abscess 653, 654 (see brain)
  - atrophy 640
  - axis 624, 626 (Fig. 247)
  - vesicles 630
- cerebrospinal meningitis 653
- cerebrum 624 (see brain)
- cestoda 240 sqq
- chalicosis 600
- chalky concretions 65
- chancre 128
  - (hard) 391, 564
  - (soft) or chancroid 391, 564
- Charcot's crystals 260, 579
- cheilognathopalatoschisis 8
- chicken-pox 388
- chigoe or chigger 226
- chilblains 367, 389
- chionyphe Carteri 222
- chloasma 362
- chloroma 162
- chlorosis, anæmia of 258, 261
  - Egyptian 231
  - hypoplasia in 272, 286
- cholecystitis 512
- cholera 473
  - anhydræmia in 258
- cholesteatoma 161, 663
- cholesterin 54
  - in gall-stones 508, 509
- chondroma 146
- choroid plexuses 628
- chronic parenchymatous nephritis 539, 544 sqq
- chronic ulcer of stomach 459
  - ulcer of duodenum 471
- chylous ascites 31, 350
  - hydrothorax 31, 235

(The numbers refer to the articles.)

- chyluria, from filariæ 235
- cicatricial tissue 82, 105
  - tissue, growth of 103, 109
- cicatrix, after necrosis 34
  - in blood-vessel 255, 256
  - syphilitic, of liver 499
- ciliata 250
- cimex lectuarius 226
- cinnabar in blood 266, 267
- circulation of kidney 521
- cirrhosis of liver 497 sqq
  - of lung 581, 592, 598, 604, 611, 616
  - pancreas 515
- cirrhotic kidney 526, 539, 547 sqq
- cirsoid aneurysm 301
- cisterns of subarachnoid 628
- Clarke's vesicular columns 626
- claustrum 625
- clavities 407
- clavus 394
- cleft palate 8, 567
- 'clegg' 226
- clostridium butyricum 186, 188, 192
- clots, post-mortem 253
- cloudy swelling 48
  - swelling of heart 274
  - swelling of kidney 534
  - swelling of liver 488
- club-foot 11
- coagulation, intravascular 252 sqq
- coagulative necrosis 35, 36
- coal-dust in blood 265, 266, 267
  - in lungs 600
- coccidium 250
  - in lung 620
- coccobacteria 185
- coeliac flux 472
- Cohnheim's embryonic theory of tumors 177 sqq
- colic, biliary 510
  - renal 531, 555
- colitis 471
- collapse of lung 591 sqq, 610
- collier's lung 600
- colliquative necrosis 40
- colloid, alveolar 507
  - cancer of intestines 478
  - cancer of stomach 462
  - casts 525, 533
  - degeneration 56
  - degeneration of thyroid 623
- combined degenerations of cord 647
- comedones 404
  - of mouth 439
- commissures of brain 625
- commotio cerebri 645
- compensatory hypertrophy of kidney 522
- composition of blood 251
- compression, softening from 644
- concentric globes 172, 663
  - hypertrophy 278
- concretio pericardii 353
- concretions, amyloid 61, 638
  - biliary 508
  - intestinal 479
  - pancreatic 514
  - salivary 448
  - urinary 560
- concussion of brain and cord 645
- condyloma 129
  - acuminatum 394, 564, 574
  - endocystic 400
  - latum 379
- congenital encephalitis 638
  - hernia 465
  - hypertrophy 18
  - syphilis of liver 500
  - tuberculosis 612
  - tumors 178
- congestion 21
  - of brain 635
  - of kidney 522
  - of liver 483
  - of lung 586, 602
  - of spleen 319
- conidia 213
- conidiophore 215
- connective tissue, metaplasia of 91
  - tissue regeneration of 85
- connective-tissue tumor 138
- contagious disease 202
  - disease, evidence of organic nature of virus in 203
- contracted kidney 525, 528, 545, 547 sqq
- contraction of stomach 454, 460
- convolutions of cerebrum 624 sqq (Figs. 243, 244)
- cord (spinal), atrophy of 639, 640
  - (spinal), compression of 644
  - (spinal), concussion of 645
  - (spinal), contusion of 645
  - (spinal), inflammations of 652 sqq
  - (spinal), malformations of 630, 632
  - (spinal), sclerosis of 646, 647, 648, 649, 650, 651
  - (spinal), softening of 643, 644
  - (spinal), structure of 626
  - (spinal), tuberculosis of 660
  - (spinal), wounds of 658
- cordyceps militaris 222
- cornea, mould-fungi on 221
- cor villosum 352
- corns 394
- cornua of cord 626
- cornu cutaneum 394
- corona radiata 625
- coronary embolism 277
- corpora albicantia 627
  - amylacea 61, 638
  - Arantii, degeneration of 276
  - geniculata 627
  - quadrigenina 627
- corpus callosum 624
  - callosum, absence of 630
- corpuscles, changes in 260 sqq
- corrosion of oesophagus 450
  - of stomach 457
- corrosive poisons on skin 389

(The numbers refer to the articles.)

- cortical centres 625
- coryza 567
- crab-louse 226
- cranial nerves 626, 627
- craniopagus 12
- craniorachischisis 7
- cranoschisis 7, 630
- cretinism 623 *a*, 634
- criminal brain 634
- croup 570
- croupous exudation 102
  - inflammation of intestine 470
  - inflammation of larynx 570
  - inflammation of lung 597
  - inflammation of mucous membrane 423
  - inflammation of nose 567
  - inflammation of œsophagus 450
  - inflammation of stomach 457
- crura cerebri 627
- crural hernia 465
- crustæ 368, 373
- culicidia 226
- cultivation of bacteria 186, 211
- cuneus 624
- cuniculi in scabies 225, 413
- cutis ænea 362, 565
- cyanoasis 271
- cyanotic atrophy of liver 483
  - induration of kidney 523
- cyclopia 7, 567, 630
- cyclops, host of Guinea-worm 234
- cylinders in urine 523, 533
- cylindrical aneurysm 301
  - epithelial cancer 173
- cyndroma 163, 173
  - of brain 663
- cystadenoma 168
  - of thyroid 621
- cystic hygroma 433, 439
  - sarcoma 448
- cysticercus cellulosa 242, 244
  - cellulosa in brain 663
  - cellulosa in kidney 557
  - cellulosa in lung 620
  - of brain 663
  - of heart 285
  - racemosus 243
  - of serous membranes 358
- cystine calculi 532, 560
- cystitis 561
- cystocele (vaginal) 563
- cystoma 168
  - multilocular, of thyroid 623
- cysts 71
  - apoplectic 636
  - biliary 511
  - dermoid 178
  - following necrosis 34
  - of intestine 464, 470
  - of jaws 441
  - laryngeal 575
  - meningeal 637
  - mucous 422, 439, 446
- cysts, pancreatic 514
  - renal 551
  - serous 358
  - of trachea 578
- dandriff 403
- daughter-cysts (echinococcus) 246
- Davaine's septicæmia 204
- decubitus 33
- decubital necrosis of larynx 576
  - necrosis of pharynx 450
  - necrosis of skin 390
- defects of the heart 270
  - of the vessels 271
- definitive inflammation 34
- degeneration, amyloid 57
  - colloid 56
  - dropsical 49
  - dropsical of kidney 535
  - fatty 50
  - gelatinous, of nerve-centres 639
  - gray, of nerve-centres 639
  - hyaline 63
  - 'hyaline-fibrous' 63
  - lardaceous 57
  - mucoid 55
  - parenchymatous 48
  - secondary, of tracts 646
  - vitreous 63
  - waxy 68
- degenerations of brain 638
  - of heart 273 sqq
  - of liver 488 sqq
  - of lung 595
  - of lymphatic glands 330 sqq
  - of neuroglia 639
  - of pancreas 514
  - of suprarenals 565
  - of spleen 325 sqq
  - of vessels 287 sqq
- Deiters' cells 639
- demarcation, line of 34, 41, 115
- dementia paralytica 648, 656, 657
- demodex 225
  - folliculorum 404
- dental osteoma 441
- dentigerous cysts 441
- deposits in kidney 529 sqq
- dermatitis 366 sqq
  - contusiformis 367
  - exfoliative 377
- dermatolysis 399
- dermatomycosis 409
- dermoid cysts 71, 178
  - tumors 358
- descending degeneration of cord 646
- desmobacteria 183, 186, 206
- desquamation 373
- desquamative catarrh 103
- destruction of blood-corpuscles 262, 268, 318

*(The numbers refer to the articles.)*

- development of blood-vessels 86
  - of urinary organs 516
- dextrocardia 272
- diabetes, kidney in 535
  - lipæmia in 259
- diapedesis 27, 96
- diaphragmatic grooves on liver 432
  - hernia 467
- dicephalus 14
- diffuse aneurysm 301
  - nephritis 541
  - sclerosis 651
- dilatation of bile-ducts 510, 511
  - of bronchi 582
  - of capillaries 305
  - of heart 278 sqq
  - of intestine 468
  - of œsophagus 449
  - of pancreatic ducts 514
  - of stomach 453, 454
  - of trachea 577
- diphtheria 443, 444, 570
  - and myocarditis 284
  - coagulative necrosis in 38
  - micrococci in 204
  - nephritis in 540, 542
  - paralysis in 669
- diphtheritic endocarditis 281, 282
  - inflammation 38, 103
  - inflammation of intestine 470
  - inflammation of larynx 570
  - inflammation of mucous membrane 424, 425, 443
  - inflammation of œsophagus 450
  - inflammation of stomach 457
- diplobacteria 185
- diplococcus 184, 185, 602
- diprosopus 14
- dipygus 15
- direct cell-division 76
- discoloration of skin 362
- disinfectants 190
- disinfection by heat 189
- disintegration of blood-corpuscles 262, 263, 318
  - cysts of 71
- dislocation, congenital 11
- dispora Caucasica 186
- dissecting-room warts 390
- distoma hæmatobium 239
  - hæmatobium in kidney 557
  - hepaticum 237
  - lanceolatum 238
  - ringeri 620
- diverticula of bladder 519
  - of intestine 464, 468
  - of œsophagus 449
- dochmitis duodenalis 231, 479
- dorsal stratum of cerebral axis 627
- dracontiasis 234
- dracunculus medinensis 234
- dropsy 23
  - of gall-bladder 511
  - of serous cavities 350
- dropsical degeneration 49
  - degeneration of kidney 535
  - lacunæ of cord 637
- dry inflammation of serous membrane 352
- dry-rot 220
- ductus arteriosus 271
  - Botalli 271
- duodenitis 471
- duodenum, ulcer of 471
- duplicitas anterior 14
  - posterior 15
- duplication of bladder 519
  - of limbs 17
  - of central canal of cord 637
  - of mammary glands 17
  - of ureter 517
  - of viscera 17
- dura mater, hæmorrhage of 664
- mater, hygroma of 664
- mater, inflammations of 664
- mater, structure of 628
- mater, tumors of 664
- dust-cells 600
  - diseases 600
- dwarfs 6, 43
- dyschromatosis 362
- dysentery 421, 472
  - hepatic abscess in 493
- dystopia of kidney 517
- ear, mould-fungi in the 221
- eburnated osteoma 147
- ecchondroses 146
  - of larynx 576
- ecchymoma 361
- ecchymoses 26, 261
- echinococcus cysts 245
  - granulosus 246
  - hydatidosus 246
  - multilocularis 247
  - scolecipariens 246
  - tænia 245
  - veterinorium 246
  - of heart 285
  - of brain 663
  - of liver 507
  - of lung 620
  - of serous membranes 358
- ectasis 305
- ecthyma 385
- ectogenous virus 203
- ectophytes 182
- ectopia cordis 9, 272
  - (ectrophia) vesicæ 9, 519
- ectoza 182
- eczema 385
  - marginatum 411
- efflorescence of skin-disease 368
- effusions 26
- effusion in serous cavities 350, 354
- Egyptian chlorosis 231
- elephantiasis arabum 315, 395, 396

(The numbers refer to the articles.)

- elephantiasis, congenital 399
  - græcorum 131
  - græcorum (see leprosy)
  - of lymphatic glands 341
- embolic abscess 257, 267
  - aneurysm 302
  - infarction 37
  - pneumonia 605
  - tuberculosis of lung 606
- embolism 29
  - of kidney 527
  - of lung 590
  - of spleen 624
- embolus 257, 263, 267, 282
- embryonic hypothesis 177 sqq
  - tissue 180
- emphysema of lung 593, 594
- empusa 222
- empyema 354
- encephalitis, congenital 638
  - purulent 654, 658, 659
- encephalocele 7, 631
- encephaloid cancer 173
  - (medullary) cancer of stomach 462
- encephalomalacia 643
- enchondroma 146
  - of skin 401
- endarteritis 293
- endemic goitre 623 *a*
- endobronchitis 581
- endocarditis 280 sqq
  - micrococci in 204
- endocardium, degeneration of 275, 276
- endocystic condyloma 400
- endogenous gemmation 76
  - virus 203
- endoneurium 666
- endophlebitis 293
- endosporium 215
- endothelial cancer 316, 358
- endothelioma 161, 316
  - melanodes 504
  - of meninges 663, 664
- endothelium of serous cavities, its nature 348
  - of vessels as impurity in blood 263
  - of vessels in organization 255
  - of vessels in thrombosis 253
- engastrius 13
- engorgement 21
  - of brain 635
  - of glottis 571
  - of kidney 523
  - of liver 483
  - of lung 556
  - of spleen 323
- engouement 602
- enlarged prostate 564
- enlargement of heart 278
  - of liver 492, 498
- 24
- enlargement of lymphatic glands 338
  - sqq
  - of spleen 321, 323, 327 etc.
- enostosis 147
- enteric fever 474
- enteritis 470
- enterocystoma 464
- enteroliths 471, 479
- enteromycosis bacteritica 477
- entophytes 182
- entozoa 182
- eosinophilous cells, 260
- epencephalon 630
- ependymal sclerosis 650
- epheles 362, 398
- epidemic cerebrospinal meningitis 653
- epidermal pearls 172, 398, 663
- epidermic globes 172, 398, 663
- epidermidophyton 376
- epigastrius 13
- epignathus 13
- epileptic brain 634
- epipygus 13, 14
- epistaxis 26, 567
- epithelial casts 533, 558
  - catarrh 420
  - pearls 172, 663
  - tumors 138, 166 sqq
- epithelioid cells in granulations 108
  - cells in tubercle 119
- epithelioma 170, 172
  - (adenocarcinoma) 431
  - (cancerous) 402
  - molluscum 400
  - of mouth 438
- epithelium, growth of 84
  - regeneration of 84
- epispadias 519
- epizoa 182
- epulis 438, 441
- equinus (pes) 11
- erectile tumors 150
  - tumors of nose 568
- ergotism 648
- erysipelas 375
  - laryngitis in 572
  - micrococci in 204, 375
- erysipelatos stomatitis 433
- erythema 360, 366
  - multiforme 367
  - nodosum 367
- essential anæmia 258
- état criblé 637, 643
- état mammelonné of stomach 456
- ethmocephalia 630
- eutrium aspergillus 216, 221
- eustachian valve, development of 270
- eustrongylus gigas 231
  - gigas in kidney 557
- exanthemata, rash in 367
- excentric hypertrophy 278
- excitability of cells 78
- exfoliative dermatitis 377
- exophthalmic goitre 623 *a*
- exosporium 215

(The numbers refer to the articles.)

- oxostosis 147
- extraneous matters in blood 265
  - matters in lymphatic glands 334 sqq
- extravasation 26
  - cysts of 71
- extroversion of bladder 519
- exudation-corpuscles 112
- exudation from serous membranes 350, 354
  - in skin disease 368
- exudations, inflammatory 96
  - inflammatory, re-absorption of 112
  - inflammatory varieties of 102
- fæcal abscess 468, 471
- fæces, parasites in, 479
- false adenoma 422
  - aneurysm 308
  - membrane 35, 102
  - membranes in croupous inflammations 423
  - membranes in serous inflammations 352
  - passages 564
- farcy 133
- fat-embolism of lung 588
- fat in blood 259, 264, 266
- fatty casts 533
  - degeneration 50 sqq
  - degeneration, cause of 52
  - degeneration of brain 638
  - degeneration of endocardium 275
  - degeneration of heart 274
  - degeneration of kidney 536
  - degeneration of liver 488
  - degeneration of lymphatic glands 332
  - degeneration of pancreas 514
  - degeneration of vessels 287
  - enlargement of heart 279
  - infiltration 50, 53
  - kidney 536, 545
  - liver 487
- favus 222, 410
- femoral hernia 465
- fenestration of valves 282
- ferro-albuminoids 268
- fermentation (see bacteria) 191, 223, 224
- fibrin 35, 252
- fibrinogen 252
- fibrinoplastin 252
- fibrinous blocks in spleen 324
  - exudation 102
  - inflammation of serous surfaces 352
  - necrosis 35, 36
- fibroblastic cells in organization 255
  - cells in arteritis 295
- fibroblasts 85
  - in granulations 108, 109
- fibroid induration of heart 277
  - induration of liver 496 sqq
- fibroid induration of lung (see cirrhosis)
  - induration of lymphatic glands 341
  - induration of pancreas 515
  - induration of spleen 321
  - induration of stomach 445
  - uterine 142, 153
- fibroma 142
  - molluscum 399, 670
- fibromyoma 153
- fibroneuroma 504
- fibroplastic degeneration 135
- fibrosarcoma 157, 160
- fibrous hyperplasia of brain and cord (see sclerosis)
  - hyperplasia of liver 496 sqq
  - hyperplasia of lymphatic glands 341
  - hyperplasia of mucous membranes 422
  - hyperplasia of stomach 456
  - tissue, growth of 85
  - tissue, regeneration of 85
- filaria in blood 265, 395
  - in kidney 557
  - medinensis 234
  - sanguinis hominis 235
- filobacteria 186
- fissura abdominalis 9
  - vesicæ 519
- fistula colli congenita 8
  - in ano 471
  - salivary 448
- fixed tissue-cells in cicatrization 111
- flagellata 250
- flea 226
- Flechsigs's zones 625
- floating kidney 517
  - liver 482
- flukes 236
- foetal atelectasis 591
  - cysts of kidney 551
  - inclusions 358
- foetus papyraceus 13
- follicular ulceration 442
  - ulcers 470
- folliculitis barbæ 405
- fomites 202
- foot-and-mouth disease 433
- foramen ovale 270
- foreign bodies in lymphatic glands 334, 335
  - bodies in trachea 577
  - substances, re-absorption of 113, 114, 115
- fowl-cholera 202, 204
- freckles 362, 398
- Friedreich's disease (hereditary tabes) 648
- frontal lobe 624
- fungi, classification of 212
  - in stomach 453
- fungous tumor 137
- fungus-disease of India 222
- funiculus gracilis 626

(The numbers refer to the articles.)

- funiculus cuneatus 626
- fur of the tongue 221, 433, 437
- furfuraceous desquamation 373
- furrows of brain 624 sqq
- furunculi 405
- fusiform aneurysm 301
- gad-flies 226
- gall-bladder, anomalies of 482
  - dropsy of 511
  - inflammation of 512
- gall-stones 508
- ganglion-cells of cord 626
- ganglia of nerves 666
- gangrene, dry 41
  - hospital 390
  - moist 42
  - of lung 598, 603
- gangrenous bed-sores 390
  - emphysema 42
  - inflammation 426, 445
- gastradenitis 459
- gastric polypi 455 (see stomach)
  - ulcer 459
- gastritis 456
- gastromalacia 453
- gastroschisis 9
- gattine* 204
- gelatinous cancer of stomach 462
  - infiltration of lung 617
  - degeneration 639, 650
- gemmation in cells 76
  - in yeasts 223
- genesis of tumors 177 sqq
- germ-theory, evidence for 203
- giant-celled cancer 173
- giant-cells 76
  - in granulations 108
  - in tubercle 119
  - in syphilis 128
- glanders 133
  - larynx 574
  - lung 618
  - mucous membrane 430, 568
- glanders-bacilli 618
- gleet 564
- gliacoccus 185
- glioma 145, 662
- gliomyxoma 663
- gliosarcoma 663
- glomeruli, development of 516
  - functions of 520
- glomerulo-nephritis 540, 545
- glossitis 434
- glossocoele 437
- glosso-labio-pharyngeal paralysis 659
- glossophytia 437
- glottis, oedema of 571
  - tumors of 575
- Gluge's corpuscles 112
- glycerine on kidney 530
- glycocholic acid 481
- glycogen 481
- glycogenous degeneration of kidney 535
- goitre 621 sqq
- Goll, columns of 626
- gonococcus 564
- gonorrhoea 204, 564
- gonorrhoeal endocarditis 281
- gout, deposits in 66
  - lead-poisoning and 526
  - kidney in 526, 531, 535
- goutte militaire* 564
- granular casts 533
  - (cirrhotic) kidney 526, 547 sqq
  - (cirrhotic) liver 497 sqq
  - ependymal sclerosis 650
  - laryngitis 570
- granulation-tissue 105
  - growth of 108
- granule-carrying cells 51
- granuloma 117
- granulomata, infective 117 sqq
- gravel 531, 560
- Graves' disease 623 *a*
- gregarinosus pulmonum 620
- gray degeneration 639, 650
- gray induration of lung 592
- grayness of hair 385
- grinder's asthma or rot 600
- grutum 364, 404
- Guinea-worm 234
- gum-boil 434, 440
- gumma 129
- gummata of brain 661
  - of heart 285
  - of liver 499, 500
  - of lung 607
  - of spleen 327
  - of throat 444
  - of vessels 295
- gummatous hepatitis 500
  - node 130
  - pneumonia 607
  - ulcer 391
- gynæcophoric canal 239
- gyri of cerebrum 624 sqq
- hæmatemesis 26
- hæmatidrosis 361
- hæmatin 68
- hæmatoblasts 35, 252, 261, 263
- hæmatocele 26
- hæmatogenous nephritis 538 sqq
- hæmatoidin 68, 268
- hæmatoma 26, 306, 361
  - arterial 308
  - of dura mater 664
  - of pancreas 513
- hæmatometra 26
- hæmatopota pluvialis 226
- hæmaturia 26
  - endemic 239
  - from filariæ 235
- hæmoglobin 68
  - infarction of kidney 530
  - proportion in blood 258, 261
  - proportion in blood after removal of spleen 318

(The numbers refer to the articles.)

- hæmoglohinuria, after hæmorrhage 349, 520, 530  
 epidemic 262  
 experimental 520  
 intermittent 262, 268  
 paroxysmal 262, 530
- hæmopericardium 26
- hæmophilia 28  
 hypoplasia in 272  
 neonatorum 28, 204
- hæmoptoë or hæmoptysis 26, 590, 613
- hæmorrhage 26  
 aneurysmal 304  
 by rupture (apoplexy) 27  
 from mucous membranes 416  
 from serous membranes 349  
 of brain 636  
 of lung 589  
 of pancreas 513  
 of dura mater 664  
 of stomach 458, 460  
 of thyroid 623  
 of thymus 623 b
- hæmorrhages of skin 361
- hæmorrhagic diathesis 28  
 erosion of stomach 458  
 exudation 102  
 infarct 26  
 infarct of kidney 527  
 infarct of lung 589  
 infarct of spleen 324  
 infiltration of kidney 530  
 infiltration of liver 484  
 infiltration of lung 589  
 inflammation of serous membranes 352  
 nephritis 544  
 softening of brain 642
- hæmorrhoids 149, 306
- hæmothorax 26
- hair, disorders of 407, 408
- hair-balls 479
- hairy men 408
- hairy tongue 437
- 'hard sore' 128
- hare-lip 8
- Haubenstrahlung* 627
- hay-bacilli, transmutation of (see bacillus subtilis) 211
- head of tape-worm 240
- heart, abnormalities of 270 sqq  
 aneurysm of 289  
 atrophy of 273  
 degeneration of 273 sqq  
 development of 270  
 dilatation of 278 sqq  
 hypertrophy of 278 sqq  
 hypoplasia of 272  
 inflammations of 280 sqq  
 malformations of 270 sqq  
 misplaced 272  
 parasites of 285  
 rupture of 274, 277
- heart, sclerosis of 277  
 size of 272, 278  
 tumors of 285
- heat, effect of, on skin 381  
 effect of, on blood 262
- hemianopsia 625, 641
- hemicephalus 7
- Henle's loops 520
- hepar mobile 482
- hepatic abscess 493, 494, 495  
 artery, closure of 484
- hepatization of lung 597, 602
- hepatitis 493 sqq  
 artificial 498  
 hiliary 498, 512  
 gummatous 500  
 indurative 496 sqq  
 purulent 493 sqq  
 sequestrans 498  
 syphilitic 499, 500  
 tuberculous 501
- heredity of phthisis 612
- hereditary tabes dorsalis 648
- hernia 464, 465  
 cerebri 7, 631  
 funis 9
- hernial aneurysm 302, 303
- herpes circinatus 367, 383  
 iris 367, 383  
 simplex, labialis etc. 383  
 tonsurans 383, 411  
 zoster 371, 383
- heterologous tumor 138
- heteroplasia 83
- heteroplastic tumor 138
- hide-bound condition 396
- high tension of arteries in apoplexy 636
- hirsuties 408
- histioid tumor 138
- histology of brain and cord 639
- hob-nailed liver 497, 498
- Hodgkin's disease 328, 344
- homœoplastic tumor 138
- homologous tumor 138
- horns of gray matter in cord 626
- horns of the skin 394
- horse-shoe kidney 517
- hospital gangrene 390
- Hunterian chancre 391
- hyaline casts 523, 533  
 change of heart 276  
 change of lymphatic glands 332  
 change of vessels 288  
 change of vessels in brain 642  
 degeneration 63  
 necrosis 35, 26
- 'hyalin-fibrous' degeneration 63
- hydatid cyst 245, 248
- hydatids 240, 245  
 of brain 663  
 of heart 285  
 of liver 507  
 of lung 620  
 of serous membranes 358
- hydræmia 258

(The numbers refer to the articles.)

- hydræmic plethora 25
- hydrobilirubin 68
- hydrocele colli 8
- hydrocephalus 631, 637
  - (causing acrania) 7, 630
  - chronic 652
- hydrencephalocele 7, 631
- hydromyelia 632, 637
- hydronephrosis 518, 552
- hydropericardium 350
- hydrophobia, encephalitis in 659
- hydrops 23
- hydrorachis 7, 632
- hydrothorax 350
  - chylous 31
- hygroma, cystic 438, 439
  - of dura mater 664
- hypalbuminosis 258
- hyperæmia 19
  - appearances of 20
  - collateral 21
  - idiopathic 21
  - of kidney 522
  - of liver 483
  - of lung 586
  - of mucous membranes 415
  - passive 21
  - of serous membranes 349
  - of skin 360
  - of spleen 319, 323
- hyperinosis 258
- hyperostosis 147
- hyperplasia, cell-processes in 72 sqq
  - of bronchi 581
  - of heart 278
  - of liver 492
  - of lymphatic glands 341
  - of mucous membrane 418
  - of skin 393
  - of spleen 328
  - of vessels 289
- hypertrichosis 408
- hypertrophic bronchiectasis 582
- cirrhosis of liver 498
- hypertrophy, congenital 18
  - cell-processes in 72 sqq
  - numerical 72
  - simple 72
  - of bladder 563
  - of heart 278, 279
  - of kidney 522
  - of liver 492
  - of stomach 455
  - of tongue 437
  - of vessels 289
- hyphæ 213
- hyphomycetes 212 sqq
  - in skin 409
  - in stomach 453
- hypophysis cerebri 665
- hypoplasia of heart 272
  - of spleen 321
  - of vessels 286
- hypospadias 519
- hypostasis 21
- hypostatic engorgement of lung 586
  - pneumonia 589
- ichthyosis 397
  - sebacea 403
- icterus 69, 259, 471, 498, 512 (see jaundice)
  - gravis 490
  - gravis kidney in 535
  - neonatorum 69, 530
- idiocy 634
- idiopathic anæmia 258, 261
  - skin-diseases 359
- ileitis 471
- imperforate anus 464
- impetigo 385
- impurities in blood 263 sqq
  - inhaled 600
- incarcerated hernia 466
- inclusio foetalis 13
- incompetence of the ostia venosa 270, 283
- incrustation 64
- indigo calculus 532
- indigo-carmine, excretion of 520
- indirect cell-division 74
- induced thrombus 253
- indurated chancre 391
- induration ardoise* 614
- induration of heart 277, 284 (see fibroid)
  - of kidney 526, 539, 547 sqq
  - of lung 587, 592
  - of lymphatic glands 337, 340
- indurative hepatitis 496 sqq
  - pancreatitis 515
  - peribronchitis 581
- infantile paralysis 659
- infarct 26, 80
- infarction, embolic 37
  - of kidney 527, 528
  - of lung 589
  - of spleen 324
- infective diseases, classification of 202
- diseases, organisms in 203
- granulomata 117 sqq
- granulomata of mucous membrane 428 sqq
- infectiveness, marks of 117
- infiltrating tumor 137
- infiltration with salts 64
- inflammation 93 sqq
  - altered blood-current in 96
  - attraction theory 94
  - causes of 98
  - definition of 93
  - diapedesis in 96
  - dilated vessels in 96
  - exudation in 96
  - later stages of 104 sqq
  - migration of blood-cells in 96
  - necrosis after 100
  - neuropathic theories of 94

(The numbers refer to the articles.)

- inflammation, recovery after 104
  - repair after 98
  - stasis in 96
  - symptoms of 98
  - temperature in 97
  - terminology of 101
  - textural changes in 99, 103
  - varieties of 101
  - vascular changes in 95, 96
- inflammations
  - of gall-bladder 512
  - of brain 652 sqq
  - of cord 652 sqq
  - of heart 280 sqq
  - of intestine 470, 471, 472
  - of kidney 538 sqq
  - of liver 498 sqq
  - of lung 596 sqq
  - of lymphatics 314
  - of meninges 652 sqq
  - of mouth 433
  - of mucous membranes 419 sqq
  - of nerves 669
  - of oesophagus 450
  - of pancreas 515
  - of serous membranes 351 sqq
  - of skin 366 sqq
  - of spleen 320
  - of stomach 456
  - of throat 442 sqq
  - of vessels 290
- inflammatory infiltration 101
  - cedema 102
  - cedema of brain 637
  - cedema of kidney 541
  - stimulus 99
  - tissue 105
- infundibulum
  - of kidney 520
  - of lung 584
- infusoria 250
- inguinal hernia 465
- inhalation-diseases 600
- inhalation in phthisis 612
- initial sclerosis of syphilis 391
- injuries of liver 482
  - of spleen 320, 326
  - of vessels 256
- inoculation in anthrax 201
  - in fowl-cholera 201
  - in septicæmia 196, 201
- insane brain 634
- insecta 226
- intention, first 110
  - second 110
- inter-brain 627
- intermedio-lateral tract 626
- internal capsule 625
  - hernia 467
- interstitial hepatitis 496 sqq
  - inflammation 101
  - nephritis 526, 542
- intestinal calculi 479
  - diverticula 9
- intestinal mycosis 206, 477
  - obstruction 467
- intestine 463 sqq
  - anomalies of 464
  - cancer of 478
  - concretions of 479
  - hernia of 465, 466
  - inflammations of 470 sqq
  - mycosis of 477
  - parasites of 479
  - syphilis of 476
  - tuberculosis of 475
  - tumors of 478
- intima in thrombosis 253
- intraparietal furrow 624
- intussusception 469
- inversio vesicæ 9, 519
- iron-compounds in blood 268
  - in liver 481
  - in lymphatic glands 334
  - in spleen 318
- iron in morbid pigmentation 68
- Irritabilität* 78
- ischæmia 21
- ischæmic softening of brain 642, 658
- ischiatric hernia 465
- ischiopagus 12
- island of Reil 624
- itch, barber's 411
  - common 413
- itch-insect 225
- ixodes ricinus 225
- janiceps 12
- jaundice 69, 259, 362, 512
  - catarrhal 471
  - from cirrhosis 498
  - malignant 490
- kakke 669
- karyokinetic cell-division 74
- karyolytic figures 75
- keloid 399
  - Addison's 399
  - cicatricial 399
- keratoma 397
- kidney, argyrosis of 530
  - atrophy of 525
  - biliary infiltration of 530
  - calcareous deposits in 532
  - degenerations of 534 sqq
  - deposits in 529 sqq
  - development of 516
  - disorders of 521 sqq
  - embolism of 527, 528
  - fatty 536, 545
  - gouty 535
  - granular 526, 547 sqq
  - hæmoglobin infarction of 530
  - hæmorrhagic infiltration of 530
  - hyperæmia of 522, 523
  - in diabetes 535
  - inflammations of 538 sqq
  - leukæmic infiltration of 530

*(The numbers refer to the articles.)*

- kidney, malformations of 516 sqq
  - mottled 545
  - necrosis of 535
  - parasites of 557
  - pigmentary infiltration of 530
  - structure of 520
  - surgical 554
  - syphilis of 550
  - tuberculosis of 549
  - tumors of 556
  - uratic infiltration of 531
  - uric acid in 531
  - white 545
- labyrinth of kidney 520
- Laennec's cirrhosis 498
- lateral sclerosis 647
- lardaceous degeneration (see amyloid)
  - 57
  - kidney 537
  - liver 491
  - spleen 325
- large-celled hyperplasia of lymphatic glands 340
- large kidney 545
- laryngeal phthisis 573
- laryngitis 570, 571, 572, 573
- larynx 569 sqq
  - malformations of 569
  - stricture of 569
- lateral sclerosis 647
- lathyrism 648, 659
- lead, action on kidney 526
  - action on nervous system 641, 667
- leaf-rust 220
- leiomyoma 153
- lenticular nucleus 625, 626
  - syphilide 379
- lentigo 362, 398
- leptomeningitis 652
- leprosy 392
  - anæsthetic 659, 669
  - bacillus of 131, 206
  - Lombardian 367
  - of larynx 574
  - of mucous membrane 430
- leptothrix 186
- leptus autumnalis 225
- leucin in acute atrophy of liver 489, 490
  - in blood 259
- leucocytes, diapedesis of 96
  - dissolve in infective diseases 201
  - in granulations 108
  - migration of 96, 99, 108
  - peripheral disposition of 96
- leucocythæmia 260
- leucocytosis 260
- leukæmia 52, 260, 328, 343, 344
- leukæmic hyperplasia of spleen 328
  - infiltration of kidney 530
  - infiltration of liver 480
  - infiltration of lung 599
- leukoderma 365
- leukomyelitis 659
- leukopathia 365
- leukoplakia 437
- Leyden's crystals 579
- lice 226
- lichen 406
  - hæmorrhagicus 361
  - pilaris 397
  - syphiliticus 379
  - urticatus 367
- lichenes 212
- lienal leukæmia 260, 328
- ligature, thrombosis from 255
- ligula nodosa 249
- lineæ albicantes 364
- lingual psoriasis 437
- lipæmia 259
- lipofibroma 144
- lipoma 144
  - of mouth 438
  - of skin 401
- lipomatosis 50
  - of heart 279
  - of liver 478
  - of pancreas 514
- lipomyxoma 144
- liquefaction, after necrosis 40
- lithopædium 6, 64
- Littre's hernia 465
- livedo 360
- liver Sect. VIII. (Part II.)
  - acute atrophy of 204
  - amyloid 491
  - anomalies of 482
  - atrophy of 485 sqq
  - cavernous tumor of 150
  - degeneration of 488 sqq
  - disorders of circulation in 483 sqq
  - enlargement of 492
  - floating 482
  - gumma of 499, 500
  - hydatid of 507
  - hypertrophy of 492
  - inflammations of 493 sqq
  - leukæmic infiltration of 480
  - metabolism in 481
  - parasites of 507
  - pigmentation of 480
  - structure of 480
  - syphilis of 499, 500
  - tuberculosis of 501
  - tumors of 502 sqq
  - wounds of 482
- liver-fluke 237
- livor 360
- livores 21
- lobules of lung 584
- locomotor ataxy 647
- Lombardian leprosy 367
- loops of Henle 520
- lung, apoplexy of 586
  - atelectasis of 591 sqq
  - cirrhosis of 592
  - collapse of 591
  - congestion of 586
  - degeneration of 595 sqq

(The numbers refer to the articles.)

- lung, disorders of 585, 586 sqq  
 emphysema of 593, 594  
 hæmorrhages of 586  
 hyperæmia of 586  
 infarction of 589  
 inflammation of 596 sqq  
 cedema of 588  
 parasites of 618, 620  
 structure of 584 sqq  
 syphilis of 609, 618  
 tuberculosis of 606, 612 sqq  
 tumors of 619
- lupus 132  
 erythematosus 380  
 larynx 574  
 of mouth 435  
 mucous membrane 430  
 nose 567  
 skin 392  
 throat 446
- lymph, changes in 269  
 functions of 251, 269  
 transudation of 23
- lymphadenitis 336 sqq  
 lymphadenoma 155, 344, 345  
 lymphangiectasis 315, 396  
 lymphangioma 152, 316, 438, 504  
 lymphangitis 314  
     in phthisis 613  
     with chancreoid 391
- lymphatic glands Sect. III. (Part II.)  
 glands degenerations 330  
     sqq  
 glands, inflammations of 336  
     sqq  
 glands in leukæmia 260  
 glands, tubercle in 122  
 glands, tumors of 343 sqq
- lymphatics in brain-disease 269  
 in cedema 24  
 morbid changes in 313 sqq  
 of lung 584  
 radicles of 269
- lymphoma 155, 338, 343  
     malignant 260, 343, 344
- lymphorrhagia 31, 315, 396  
 lymphorrhœa 152  
 lymphsarcoma 155, 158, 344, 345  
 lymph-spaces of brain 628  
 lyssa 659
- macrocheilia 315, 437  
 macrocytes 261  
 macroglossia 315, 437  
 madura-foot 222  
 maggots 236  
     in nose 568  
 maggot-worm 229  
 malaria (see bacillus malarie) 206  
     melanæmia in 262  
     nephritis in 642  
     spleen-changes in 321
- malformations, artificially produced 3, 5  
     congenital Sect. I. (Part I.)
- malformations fissural 7, 8, 9  
     of the brain 630 sqq  
     of the cord 632  
     of the heart 270 sqq  
     of the lung 585  
     of the nose 567  
     of the organs 11  
     of the thyroid 621  
     of the trachea 577  
     of the urinary organs  
         516 sqq  
     of the vessels 286  
     origin of 2, 3, 12
- malignancy 140  
 malignant adenoma (see adenocarcinoma)  
     cedema 188, 204, 206  
     pustule, 390
- malpighian bodies of kidney 516  
     follicles, new-formed 318  
     follicles of spleen 317  
     pyramids of kidney 520
- malposition of the organs 11
- mal rosso (del sole) 367
- malum senile arteriarum 299
- marasmic thrombosis 253
- margaric acid 54
- margarin-crystals 54
- marginal convolution 624  
     sclerosis of cord 651
- marrow in leukæmia 260
- mason's lung 611
- matter or pus 102, 108
- maw-worm 228
- measle of brain 663  
     of pork 242, 243
- measles 367
- meat-poisoning 206, 477
- Meckel's diverticulum 9, 464, 465
- mediastinal tumors 358
- medulla oblongata 627
- medullary cancer 173  
     cancer of stomach 462  
     leukæmia 260  
     rays of kidney 520  
     sheath of nerves 666
- melæna neonatorum 458
- melanæmia 262
- melanin 67
- melanocarcinoma 173
- melanoma 162
- melanosarcoma 162  
     of liver 504
- melasma suprarenale 565
- membranaceous desquamation 373
- membranes of brain and cord 628
- membranous croup 570
- meninges, structure of 628
- meningeal dropsy *ex vacuo* 637  
     tumors 663
- meningitis 204  
     chronic 655, 656  
     purulent 653  
     serous 652  
     tuberculous 660

(The numbers refer to the articles.)

- meningocele 7, 631, 632  
 meningoencephalitis 656  
 meningomyelitis 656  
 mentagra, acne 405  
 mental disorders 629  
 merulius lacrimans 220  
 mesarteritis 293  
 mesencephalon 630  
 mesoblastic tumor 138, 142 sqq  
 mesobronchitis 581  
 mesonephron 517  
 mesophlebitis 293  
 metamorphosis (see degeneration)  
 metaplasia 90  
 metastases in cancer 174  
 metencephalon 630  
 methæmoglobin 259  
 methæmoglobinuria 530  
 metritis 204  
 metrorrhagia 26  
 miasmatic disease 202  
 miasmo-contagious disease 202  
 micrencephalia 633  
 microbacteria 183, 185, 205  
 microbrachius 10  
 microcephalia 633  
 micrococci in acute yellow atrophy 490  
     (see bacteria)  
     in arteritis 291  
     in diphtheria 444  
     in dysentery 472  
     in endocarditis 281  
     in erysipelas 375  
     in gangrene of skin 390  
     in hepatic abscess 493, 494  
     in lupus 132  
     in lymphatics 269  
     pathogenous 204  
     in plebitis 291  
     in purulent effusion 354  
     in small-pox 388  
     in softening of thrombi 254  
     in syphilis 391  
 micrococcus 184  
     cyaneus 191  
     diphtheriticus 185  
     erysipelatis 204, 375  
     luteus 184, 191, 195  
     prodigiosus 191, 211  
     septicus 185, 199, 204  
     variola 204  
 microcytes 261  
 microcythæmia 261  
 microgyria 633  
 micromelus 10  
 micromyelia 633  
 microparasitic theory of contagium 203  
 micropus 10  
 microsporina 185  
 microsporon furfur 222, 412  
 Miescher's cylinders 250  
 migration of leucocytes 96, 99, 108  
 mikrosomia 6  
 mildew (vine) 220  
 miliaria crystallina 382  
 miliary aneurysms 303, 636  
     syphilide 379  
     tubercle 118  
     tumors 137  
 milium 364, 404  
     of mouth 439  
 milk-spot of pericardium 352  
 miner's lung 70, 600  
 mitral stenosis 283  
 mixed cancerous tumors 176  
     connective-tissue tumors 164 sqq  
 mole, congenital 179  
     fleshy 6  
     hydatidiform 6  
 moles 362, 398  
     sarcoma in 401  
 molluscum bodies 400  
     contagiosum 400  
     elephantoid 399  
     fibroma 142  
 monadina 185  
 monads in intestine 479  
     in lung 620  
 monas hæmorrhagicum 204  
     lens 620  
 monobrachius 10  
 monopus 10  
 monsters, double 1, 5, 12 sqq  
     double, origin of 5, 12  
     single 1, 6 sqq  
 monstrosities by defect 3  
     by perversion 4  
 morbilli 367  
 morbus Brightii 539  
     maculosus Werlhofii 361  
 morels (mushrooms) on blood 262  
     (mushrooms) on kidney 530  
 mortification (see gangrene)  
 mosquitoes 226  
     hosts of filaria 235  
 mother's marks 398  
 motor centres of cerebrum 625  
 mottled kidney 545  
 mould-fungi 212 sqq  
     in invertebrates 222  
     in lung 620  
     in moist gangrene 42  
     mutability of 219  
     pathology of 221  
     reproduction of 218  
 mouth 433 sqq  
 movable kidney 517  
 mucoid change of heart 276  
     degeneration 55  
 mucor mucedo 215, 221  
     mucedo, mutability of 219  
     racemosus 219  
 mucous cysts 422  
     membranes Sect. VI. (Part II.)  
     membranes, atrophy of 417  
     membranes, degeneration of 417  
     membranes, hæmorrhage from 416  
     membranes, hyperæmia of 415

*(The numbers refer to the articles.)*

- mucous membranes, hyperplasia of 418  
 membranes, hypertrophy 418  
 membranes, inflammations of 419 sqq  
 membranes, structure and functions of 414  
 membranes, tubercle of 124, 428  
 patch 129, 379  
 tissue, growth of 85  
 mucus-corpuscles 414  
 muguet 436  
 Müllerian duct 516, 518  
 multiple neuritis, 667  
     sclerosis 649, 650  
 multiplication of cells, causes of 80, 81  
 mummification 41  
 mumps 447  
 muscle, growth of 89  
     regeneration of 89  
 mutability of bacteria 208 sqq  
 mycelium 213  
 mycetoma 222  
 mycoderma 223  
     vini 436  
 mycomycetes 212  
 mycoprotein 183, 184  
 mycosis, intestinal 206  
     of lungs 221  
     microsporina 412  
 myeline 666, 667  
 myelitis, purulent 654, 659  
     transverse 659  
 myelogenic leukaemia 260  
 myelomalacia 643  
 myelomeningocele 632  
 myeloid cancer 173  
     sarcoma 159  
 myocarditis 280 sqq  
 myoma 153  
 myomalacia cordis 277  
 myosarcoma 153  
 myxoma 143  
     of skin 401  
 myxoedema 623 a  
 myxofibroma 143  
 myxolipoma 143  
 myxomycetes 212  
 myxosarcoma 163  
  
 nævi 149  
 nævus pigmentosus 362, 398  
 nails, disorders of 407, 408  
 nanosomia 6  
 nasal cavities, disorders of 567  
     polypi 568  
 neck of hernial sac 465  
 necrobiosis of vessels 288  
 necrogenic warts 390  
 necrosis 32 sqq  
     after inflammation 100  
     anaemic 33, 40  
     coagulative 35, 56  
     colliquative 40  
     of lymphatic glands 333, 337  
     necrosis of mucous membrane 417, 426  
         of pharynx 450  
         of skin 389  
         of vessels 258, 291  
     necrosis mycotica typhosa 572  
     necrotic inflammation 103  
     nematoda 227 sqq  
     nephritis 538 sqq  
     nephrolithiasis 532  
     nerves, atrophy of 667  
         inflammations of 669  
         regeneration of 668  
         severed 668  
         structure of 666  
         tumors of 370  
     nerve-tissue, growth of 89  
         regeneration of 89, 668  
     nervous disease, causes of 629  
     neurofibroma 399, 670  
     neuritis 667, 669  
         migrans 669  
     neuroglia, growth of 85  
         structure of 625, 626, 639  
     neuro-keratin 639  
     neuroma 154, 670  
     neuromata, amputational 154, 668  
         false 399  
         ganglionic 670  
         medullary 633  
         papillary 399  
     neuropathic papilloma 397  
         theories of inflammation 94  
     neurotization 668  
     new blood-vessels, growth of 86  
         blood-vessels in granulations 109  
     'nightingale' (two-headed) 14  
     nitrite of amyl on blood 262  
     nitrobenzol on blood 262  
     node, syphilitic 130  
         of Ranvier 666  
     nodular tumor 137  
     noma 434  
     non-pathogenous bacteria 197  
     nose, disorders of 567, 568  
     nosema bombycis 204  
     nuclear figures 74, 75  
     nucleated red corpuscles 260, 261  
     nucleolus (nuclear or nucleolar corpuscle) 74  
     nucleus-division 74  
     nucleus, structure of 74  
     nuclei of cerebrum 625  
         of cranial nerves 627  
         of medulla 627  
     nutmeg-liver 483, 487  
  
     obesity 50  
         of heart 279  
     obliterating thrombus 253  
     obturator hernia 465  
     occipital furrow 624  
     occlusion of lymphatics 315  
         of vessels 307  
         of vessels in liver 484  
     odontoma 441

*(The numbers refer to the articles.)*

- cedema 23  
   cachectic 25  
   hydræmic 25  
   inflammatory 25, 102  
   malignant 206  
   purulent 102  
   varieties of 24  
   of brain 637, 652  
   of glottis 571  
   of lung 587, 588  
   of skin 360  
 cedema-bacilli 206  
   transmutation of 211  
 cesophagus 449 sqq  
 cestrida 226  
 oidium 214, 220, 222  
   albicans 436  
   identical with mycoderma 224  
 oil-drops in fatty degeneration 51  
 oligæmia 21, 258  
 oligocythæmia 258, 261  
 olivary nuclei 627  
 omentum, hernia of 465 sqq  
   tuberculosis of 356  
 omphalopagi 12  
 odontoma 147  
 onychogryphosis 232, 408  
   favosa 410  
   tonsurans 411  
 oogonium 218  
 oosphere 218  
 oospore 218  
 optic thalamus 627  
 'organization' 86  
   of thrombi 255  
 organoid tumor 138  
 osteoblasts 88  
 osteoclasts 115  
 osteoid chondroma 165  
 osteoma 147  
   dental 441  
 osteophyte 147  
 osteosarcoma 165  
 ostia, defects at 270  
 ovigenous organ in tænia 241  
 oxalic acid calculi 532, 560  
 oxyuris vermicularis 229, 479  
 ozæna 567  
 pacchionian bodies 628  
 pachydermatocele 399, 670  
 pachydermia 395  
 pachymeningitis 664  
 packing-cells 216  
 palate, soft 442  
 panaritium 390  
 pancreas 513 sqq  
 panneuritis epidemica 669  
 panophthalmitis causing meningitis 653  
 papillæ of kidney 520  
 papilloma 137  
   of bronchi 582  
   of larynx 575  
   of mucous membrane 422,  
     446  
   papilloma of stomach 455, 456  
   papillomata, inflammatory 394  
     neuropathic 397  
 papulæ 366  
 papular syphilide 379  
 paracentral lobule 624  
 paraglobulin 252  
 parallel furrow 624  
 paralysis of the insane (paralytic de-  
   mentia) 648, 656, 657  
 paramœcium coli 250, 479  
 parasites Sect. VII. (Part I.)  
   animal 225 sqq  
   in blood 265  
   vegetable 183 sqq  
   of heart 285  
   of intestine 479  
   of kidney 557  
   of larynx 575  
   of lung 620  
   of liver 507  
   of mouth 436  
   of skin 400 sqq  
 parasitic twin 13  
 parchment skin 364  
 parenchymatous inflammation 101  
   nephritis 539, 544 sqq  
 parietal lobe 624  
   thrombus 253  
 paronychia 390, 408  
 parostoses 147  
 parotitis, epidemic 447  
 paroxysmal hæmoglobinuria 262, 530  
 parulis 434, 440  
 Pasteur's septicæmia 188, 204, 206  
 pathogenous bacteria 195, 196, 198, 210-  
   sqq  
 pearls, epidermal 172, 398, 663  
 pearly disease (bovine) 127, 206  
   tumor 161, 663  
 pébrine 204  
 pediculi 226  
 peliosis rheumatica 361  
 pellagra 367, 648  
 pelvis of kidney 520  
 pemphigus 384  
   syphiliticus 386  
 penicillium glaucum 217  
 pentastoma  
   constrictum 225  
   denticulatum 225  
   denticulatum in kidney  
     557  
   denticulatum in lung 620  
   in liver 507  
   in spleen 329  
   in tæniodes 225  
 perforating ulcer of stomach 459  
   ulcer of duodenum 471  
 perforation of intestine 468  
   of cesophagus 449, 451  
   of stomach 460  
   of trachea 577  
   of valves 282  
 periarteritis 293  
   causing aneurysm 302

*The numbers refer to the articles.)*

- peribronchitis 581  
 pericarditis 352, 353, 354  
     tuberculous 357  
 pericardium, development of 348  
 perichondritis, laryngeal 576  
 pericystitis 561  
 periencephalitis, chronic 656  
 perihepatitis, syphilitic 500  
 perilymphangitis 314  
 perineal hernia 465  
 perinephritic abscess 543, 554  
 perineurium 666  
 periostitis, infective 204  
 peripheral disposition of leucocytes 96  
     nerves in tabes dorsalis 648  
     nervous system Sect. XII.  
     (Part II.)  
 periphlebitis 293  
 periproctitis 471  
 perisplenitis 321  
 perithecium 216  
 peritoneal absorption 349  
     fascia of hernia 465  
 peritoneum, development of 348  
 peritonitis 352, 353, 354  
     deformans 553, 454  
     tuberculous 357  
 perityphlitis 471  
 perniones 367, 389  
 perobranchius 10  
 perochirus 10  
 perodactylus 10, 18  
 peromelus 10  
 peronospora infestans 220  
 petalobacterium 185  
 petalococcus 185  
 petechiæ 26, 361  
 petrification 64  
 Peyer's patches 346  
     patches in typhoid 474  
 pharyngitis 442  
 pharyngocele 449  
 pharynx 449 sqq  
 phlebitis 291, 293  
 phleboliths 254, 306  
 phlegmon laryngis 571  
 phlegmonous inflammation of larynx  
     571  
     inflammation of mucous  
     membranes 427  
     inflammation of nose 567  
     inflammation of œsoph-  
     agus 450  
     inflammation of skin 390  
     inflammation of stomach  
     457  
     inflammation of throat  
     445  
 phlyctænoses 368  
 phocomelus 10  
 phosphatic calculi 533, 560  
 phosphorus, causing fatty change 52  
     poisoning 434, 490  
 phthisical sputum, inhalation of 601  
 phthisis, bacilli in sputum of 206  
 phthisis, minute aneurysms in 303, 304  
     pulmonary 614  
     tuberculous pleurisy in 356,  
     357, 613  
     tuberculous 612, 613, 614,  
     615  
 phycomyces 215  
 phycomycetes 212  
 pia mater 628  
     mater pigmentation of 638  
 pigment in blood 265 sqq  
     in brown atrophy 273  
     in lymphatic glands 334, 335  
 pigmentary atrophy 45  
     atrophy of liver 486  
     infiltration of kidney 530  
     infiltration of liver 480  
     induration of stomach 456  
 pigmentation of skin 362  
 pigments, hæmatogenous 68  
     normal 67  
 pigment-spots, congenital 179  
 piles 149, 306  
 pineal body 665  
 pits of small-pox 374, 387  
 pituitary body 665  
 pityriasis 222  
     rosea 412  
     rubra 374, 377  
     tabescentium 364, 403  
     versicolor 412  
 plagues 203  
 plaques opalines 435, 437  
 plastic bronchitis 579  
 pleomorphism in fungi 218  
 plethora 258  
 pleura, development of 348  
 pleurisy 352, 353, 354  
     tuberculous 357  
 pleuro-pneumonia of cattle 605, 608  
 plexiform neurofibroma 670  
     angiosarcoma 161  
 pneumonia, catarrhal 204  
     croupous 204, 602  
     croupous micrococci in 602  
     dissecting 608  
     forms of 602 sqq  
     hypostatic 589  
     nephritis in 542  
     pleurogenous 599, 608  
 pneumonococcus 602  
 pneumonoconiosis 600  
 pneumonocystis 620  
 pneumothorax 609, 616  
 poikilocytosis 261  
 poliomyelitis, acute 659  
 poliomyelitis anterior 640, 659  
 poliosis 365  
 pollinodium 216  
 polyæmia 258  
 polymelia 15  
 polymorphism in fungi 212, 218  
 polyneuritis 669  
 polyposis ventriculi 456  
 polypous growths of intestine 470, 478,

(The numbers refer to the articles.)

- polypous growths of mucous mem-  
brane 418
- growths of larynx 575
- growths of nose 568
- growths of stomach 455, 456
- tumor 137
- polypus of heart 253, 277
- of larynx 575
- of nose 568
- polytrichia 408
- polyuria in nephritis 539
- pons Varolii 627
- popliteal aneurysm 303
- porencephalia (porencephalus) 630
- porrigo decalvans 407
- portal system of kidney 520
- vein, closure of 484
- vein, engorgement of 497
- post-mortem clots 253
- mortem staining 21
- potassium chlorate on blood 262
- chlorate on kidney 530
- potato-disease 220
- præcentral furrow 624
- præcuneus 624
- primary sclerosis of cord 647, 648
- thrombus 253
- primordial kidneys 516
- proctitis 471
- proglottis 240
- progressive paralysis of the insane 648, 656
- projective system of brain 625
- prolapse 464
- of bladder 563
- of bowel (anus) 469
- of the tongue 437
- proliferation, cell-processes in 73
- factors of 80, 81
- proscolices 240
- prosencephalon 630
- prostate, enlarged 564
- prostatic concretions 61
- protection by inoculation 201
- protophyta 223
- protozoa 250
- prurigo 377
- psammoma 162, 663, 664, 665
- pseudo-diphtheritis 424
- pseudoleukæmia 260, 261, 328, 344
- pseudo-parenchyma 216
- psoriasis 376
- syphilitic 379, 435, 437
- psorospermia 250
- in lung 620
- psychical functions of brain 625
- puerperal peritonitis 204
- pulex irritans 226
- penetrans 226
- pulmonary vessels 584
- œdema 588
- puriform softening of thrombi 254
- purpura, blood-changes in 261, 268
- hæmorrhagica 361
- papulosa 361
- purpura rheumatica 361
- scorbutica 361
- senilis 361
- simplex 361
- variolosa 361, 387
- purulent arteritis 291
- catarrh 102, 204, 420
- encephalitis 654
- exudation 102
- hepatitis 493
- meningitis 653
- myelitis 654
- myocarditis 284
- œdema 102
- phlebitis 291
- pus, origin of 99, 102, 107, 108, 112
- pustulæ 368, 372
- pustulation 372, 388
- pustule, malignant 390
- putrefaction in moist gangrene 42
- putrefactive diseases 204
- putrid decomposition 191, 192, 197
- exudation 102
- pyæmia 204
- spleen-change in 320, 322
- from thrombosis 291
- pyelitis 553, 554, 555
- micrococci in 204
- pyelonephritis 554
- pygopagus 14
- pylephlebitis 484
- pylorus, stenosis of 453, 454, 460
- pyonephrosis 554
- pyopneumothorax 616
- pyramidal tracts 626
- pyrexia, kidney in 525
- pyrogallic acid on blood 262
- quinine-rash 367
- racemose aneurysm 289, 301
- Rainey's corpuscles 250
- ranula 439, 448
- pancreatic 514
- rash from medicaments 367
- from specific fevers 357
- ray-fungus 436
- re-absorption 104
- imperfect 112
- recovery after inflammation 104
- rectum, (see intestine)
- syphilitic disease of 476
- red atrophy of liver, acute 489
- atrophy of liver, central 483
- corpuscles, genesis of 261, 318
- corpuscles, destruction of 262, 268, 318
- corpuscles, nucleated 260, 261
- nucleus 627
- softening of brain 642
- softening of thrombi 254
- regeneration after inflammation 104
- after necrosis 34
- cell-processes in 72 sqq
- of nerves 668

(The numbers refer to the articles)

- regurgitation 279, 283  
 Reil, island of 624  
 relapsing fever, spirillum of (see spiro-  
 chæta Obermeyer) 207  
 renal calculi 531  
     circulation 521  
     cirrhosis 539, 547 sqq  
     cysts 551  
     disease 521 sqq  
     disease and cardiac hypertrophy  
     279  
     parasites 557  
     syphilis 550  
     tuberculosis 549  
     tumors 556  
 renculi 517  
 respiratory organs Sect. x. (Part II.)  
     bronchiole 584  
 resting-spore 215  
 retention, cysts of 71  
 reticular induration of lymphatic glands  
     341  
 retroperitoneal hernia 467  
 Reverdin's skin-grafting 84  
 rhabdomyoma 153  
 rhachischisis 630  
 rhagades 373  
 rheumatic endocarditis 281  
 rhinitis 567  
 rhinoliths 568  
 rhinophyma 400  
 rhizopoda 250  
 rhythmic contraction of spleen 318  
 rice-water stools 473  
 rigor caloris in bacteria 189  
     frigoris in bacteria 189  
 ringworm 222  
     common 411  
     crusted 410  
 rodent ulcer 402  
 roestelia cancellata 220  
 rolandian fissure 624  
 roseola 360, 367  
     furfuracea herpetiformis 412  
 rostellum of tænia 241  
 'rot' in sheep 237  
 round-celled sarcoma 158  
 round ulcer of duodenum 471  
     ulcer of stomach 459  
 round-worm 228  
     in kidney 557  
     in larynx 575  
 rubeola 367  
 rupia syphilitica 386, 391  
 rupture of blood 563  
     of heart 258, 274, 277  
     of œsophagus 449  
     of spleen 320, 326  
     of vessels 308  
     (hernia) 465  
 saccharomyces 223  
     albicans 436  
     albicans in nose 568  
 sac of hernia 465  
 sacculated aneurysm 301  
 sago-spleen 57, 325  
 saliva, causing septicæmia 204  
 salivary calculus 448  
     fistula 448  
     glands 447, 448  
 sanious exudation 102  
 saprophytes 221  
     in mouth 436  
     in lung 620  
 sarcina 184, 185, 204  
     in lung 620  
 sarcoma 156 sqq  
     alveolar 161  
     myeloid 159  
     myxomatodes 163  
     peculiar 161  
     round-celled 158  
     spindle-celled 160  
     varieties of 157  
     (see tumors) of liver 504  
     of lymphatic glands 356  
     of mouth 438  
     of skin 401  
 sarcophagus crystals 533  
 sarcoptes 225  
 scabies 413  
 scabs 373  
 scales 373  
 scar, syphilitic of liver 499  
 scarlatina 367  
     laryngitis in 572  
     micrococci in 204  
     nephritis in 540, 542, 543  
 schistomycetes 183 sqq  
 schistoprosopia 8  
 schizomycetes 183 sqq, 212  
 Schneeberg miners' disease of lung 619  
 scirrhus cancer 173  
 scirrhus of stomach 462  
 sclerema neonatorum 396  
 scleroderma 396  
 sclerosis (fibrous hyperplasia) 82, 111,  
     129  
     marginal 651  
     multiple 549, 650  
     posterior 647, 648  
     primary 647, 648  
     secondary 640, 646  
     of cord, 646, 647, 649, 650, 651  
     of heart 277, 284  
     of kidney 526  
     of nerve-tissues 639  
     of vessels 293, 297  
     of vessels causing aneurysm  
     302  
 sclerotium 217  
 scolecida 227 sqq  
 scolex 242  
 scrofula 127  
 scrofulous lymphadenitis 339  
     pneumonia 618  
     ulcer 391  
 scurvy 361  
     blood-changes in 261

*(The numbers refer to the articles.)*

- scutula of favus 410  
 scybala 471  
 seat-worm 229  
 sebaceous cysts 404  
     disorders 403 sqq  
     wart 400  
 seborrhœa 403  
 secondary thrombus 253  
 senile atheroma 299  
     atrophy of brain 640  
     atrophy of skin 364  
     kidney 526  
     retrogression 45  
 sensory-motor zone 625  
 sepsin 191, 197  
 septa of the heart, anomalies of 270  
 septicæmia, Davaine's 204  
     from saliva 204  
     of mice 201, 204  
     micrococci in 204  
     Pasteur's 188, 204, 206  
 septic poison 191, 197  
     pneumonia 605  
 sequestrum 115  
 serous catarrh 102  
     cavities, development of 348  
     cysts 358  
     exudation 102  
     membranes, Sect. IV. (Part II.)  
     membranes, effusion from 330  
     membranes, hyperæmia of 349  
     membranes, inflammations of 351  
     membranes, parasites of 358  
     membranes, tuberculosis in 355,  
     356  
     membranes, tumors of 358  
 serpent-venom on blood 262  
 sheath of Schwann 666  
 shellac-concretion in intestine 479  
 shingles 383  
 Siamese twins 12  
 siderosis 268, 600  
 silique desquamation 373  
 silk-worm-diseases 204  
 silver-staining 70  
 simple atrophy of liver 485  
     cancer 173  
 siren-monster 10  
 situs transversus (heart) 272  
     transversus (inversus) 11  
     transversus (liver) 482  
 skin, atrophy of 363 sqq  
     discoloration of 362  
     diseases of Sect. V. (Part II.)  
     functions of 359  
     hyperæmia of 360  
     hyperplasia of 393, 397  
     inflammations of 366 sqq  
     inflammatory hypertrophy of 393  
     sqq  
     parasites of 409 sqq  
     tumors of 399 sqq  
     ulcers of 391  
 skin-diseases, classification of 359  
     fungi in 222  
 skin-grafting 84  
 slough 115  
 small-pox 361, 372, 374, 387  
     laryngitis in 572  
     micrococci in 204  
 softening 40  
     of brain 639, 642  
     of heart 277  
     of œsophagus 449  
     of stomach 453  
     of thrombus 254, 257  
 soil, anthrax-spores in 206  
     bacteria in 193  
 somatic death 32  
 spasm of œsophagus 449  
 'specific inflammations' 117  
     nature of tissues 77  
 spermatozoid 218  
 sphacelus 42  
 sphærobacteria 184  
 spina bifida 7, 632  
     ventosa 135  
 spinal cord (see cord), structure of 626  
     paralysis, anterior, 659  
 spirillum of relapsing fever (see spiro-  
     chæta Obermeyeri) 207  
     tenue 187  
     undula 187  
     volutans 185, 187  
 spirobacteria 184, 187, 207  
 spirochæta denticola 187  
     Obermeyeri 185, 187, 207  
 spleen, changes in Sect. III. (Part II.)  
     congestion of 319  
     degenerations 325  
     engorgement of 323  
     enlargement of 321, 323, 327 etc  
     granulomata of 327  
     hyperplasia of 328  
     inflammation of 320  
     in leukæmia 260, 328, 329  
     rupture of 320, 326  
     structure and functions 317, 318  
     suppuration of 322  
     tumors of 329  
 splenic abscess 322  
 spleniculus 317  
 splenization of lung 589  
 splenitis 320  
 sporangia 214, 215  
 sporangio-phore 215  
 spores of mould-fungi 213  
 sporozoa 250  
 spurious aneurysm 308  
 sputum of pneumonia 602  
     of phthisis 613  
 squamæ 368  
 squamous epithelial cancer 173  
 staining, post-mortem 21  
 starvation, liver in 485  
 stasis (as a cause of necrosis) 33  
 steatoma 404  
 steatorrhœa 403  
 steel-dust in blood 265, 268  
 stellate veins of kidney 520

(The numbers refer to the articles.)

- stenosis of the great vessels 271, 279  
 of the bronchi 580  
 of the intestine 468  
 of the larynx 569  
 of the œsophagus 449  
 of the ostia venosa 270, 282  
 of the pylorus 453, 454  
 of the trachea 577
- sterigma 216
- sternopap 12
- St. Gothard tunnel, anchylostoma in 231
- stigmata 27, 97
- stimuli, action of, on cells 79
- stomach, 452 sqq  
   anomalies of 454  
   cancer of 461  
   corrosion of 457  
   dilatation of 453, 454  
   erosion of 458  
   fermentation in 453  
   fungi in 221  
   hæmorrhage of 458  
   hypertrophy and atrophy of 455  
   induration of 456  
   inflammations of 456, 457  
   polypi of 455, 456  
   softening of 453  
   tumors of 461  
   ulcer of 456, 459
- stomata 27, 97  
   of serous surfaces 348
- stomatitis 433
- stomoxys calcitrans 226
- stone 560
- storage-fat 53
- strangulation of hernia 466
- streptobacteria 185
- streptococci 185
- stricture of larynx 569  
   of œsophagus 449  
   of pylorus 453, 454  
   of trachea 577  
   of urethra 519 (congenital), 564
- strongylus duodenalis 231  
   longevaginatus (bronchialis) 231, 620
- struma (goitre) 621
- strumæ lipomatodes 556  
   lipomatosæ suprarenales 565
- strumitis 623
- strumous inflammations 204
- subarachnoid 628
- subcutaneous emphysema 593
- subthalamie region 627
- suctorial worms 236
- sudamina 382
- sugillations 26
- sulphindigotate of sodium, excretion of 520
- sulphuretted hydrogen poisoning 259
- sulphuric acid on blood 262
- sun-burn 362
- sun-spots 362
- sun-stroke, anhydræmia in 258
- supernumerary bones and muscles 16  
   mammaræ 16
- suppurating bubo 337
- suppuration (see pus) 112  
   of kidney 543  
   of liver 493 sqq  
   of lung 598, 603  
   of lymphatic glands 337  
   of mouth 434  
   pancreas 515  
   spleen 322
- 'suppuration of the blood' 260
- suppurative nephritis 543
- suprarenales in Addison's disease 352, 565  
   disorders of 565
- surgical kidney 554, 561
- suture of nerves 668
- sweat-glands, adenoma of 402
- sycosis nonparasitaria 405  
   parasitaria 405, 411
- sylvian fissure 624
- symptomatic anthrax 206  
   skin-diseases 359
- sympus 10
- syncephalus 12
- syndactylus 10
- synophthalmia 7, 630
- synotia 8
- syphilides, papular 379, 391  
   pustular 386
- syphilis 128 sqq  
   micrococci in 206  
   of brain 661  
   of bronchi 579  
   of cord 601  
   of intestine 476  
   of larynx 574  
   of kidney 550  
   of mouth 435  
   of mucous membranes 429  
   of throat 446  
   of trachea 578
- syphilitic arteritis 295  
   bubo 342, 391  
   chancre 391  
   enlargement of spleen 327  
   hepatitis 499, 500  
   laryngitis 574  
   origin of tabes dorsalis 648  
   pneumonia 607  
   teeth 441  
   tracheitis 578
- syphiloma of heart 285  
   of liver 500
- syringomyelia 637
- systemic degeneration of cord 646, 648
- tabanida 226
- tænia cucumerina 244, 479  
   echinococcus 245  
   elliptica 244  
   malformations of 243, 244

*(The numbers refer to the articles.)*

- tænia mediocanellata 244, 479  
     nana 244, 479  
     saginata 244, 479  
     solium 241, 479  
 tahes dorsalis 647  
 tape-worms 240 sqq  
 tarichium megaspermum 222  
 tartar of teeth 440  
 tatooing 70, 334, 362  
 taurocholic acid 481  
 teeth, changes in 440  
     syphilitic 441  
 tegmental region 626, 627  
     radiations 627  
 telæ choroideæ 628  
 telangiectasis 152, 305  
 temperature, effect on bacteria 189  
     effect on moulds 219  
 temporal furrows 624  
 teratoid tumors 358  
 teratoma 13, 178, 179  
 textural changes in inflammation 99  
     changes in inflammation, varieties of 103  
 thalamencephalon 630  
 thalamus, optic 627  
 thallophytes 212  
 thoracic duct, closure of 315, 396  
     duct, rupture of 31  
 thoracogastroschisis 9  
 thoracopagus 12  
     parasiticus 13  
 thread-worm 229  
 throat 442  
 thrombophlebitis 254, 291  
 thrombosis 29, 252  
     cardiac 253  
     factors in 253  
     from atheroma 300  
     in aneurysms 305  
     issues of 254, 255  
     marasmic 253, 256  
     of kidney 523  
     of lymphatics 315  
 thrombus 252  
     calcification of 254  
     mottled 252  
     organization of 255  
     red 252  
     softening of 254  
     white 252  
 'thrush' 224, 433, 436, 449, 479  
 thymus gland 623 b  
     gland, atrophy of 331  
     gland, lymphadenoma of 345  
 thyreocele 621  
 thyroid gland 621 sqq  
 thyroiditis 623  
 Tierra del Fuego, natives of 472  
 tight-lacing 482  
 tineæ 222  
     favosa 410  
     furfuracea 403  
     syccosis 411  
     25  
     tinea tonsurans 411  
         versicolor 412  
     tipulida 226  
     tonsils 442 sqq  
     torula 223  
     trabecular induration of lymphatic glands 341  
     trachea, disorders of 577  
     tracheitis 578  
     tracheotomy-granulations 578  
     tracts of cord, degeneration of 646  
     transverse-frontal furrow 624  
     transverse myelitis 659  
     trematoda 236  
     tricephali 16  
     trichina spiralis 232, 233, 479  
     trichinæ in blood 265  
         in larynx 575  
         in peritoneum 358  
     trichocephalus dispar 230, 479  
     trichomonas 250  
     trichophyton tonsurans 222, 411  
     triple-phosphate 531, 560  
     triplets, homologous 16  
     tropical abscess of liver 493  
     tube-casts 523, 533  
     tuheraceæ 216  
     tubercle 168 sqq  
         clinical characters of 125  
         crude 121  
         definition of 118  
         inoculability of 125  
         miliary 118  
         of heart 285  
         of liver 501  
         of spleen 327  
         in blood-vessels 234, 264, 296  
     tubercula 366, 368  
     tuberculosis (see bacillus tuberculosis)  
         188 sqq  
         acute miliary 123  
         bacillus of 120, 127, 186, 206  
         diffusion of 121, 122, 124  
         in lung 606, 612, 613  
         in sputum 613  
         of brain 660  
         of bronchi 579  
         of intestine 475  
         of bladder 561  
         of kidney 549  
         of larynx 572  
         of liver 501  
         of lung 606, 612, 613  
         of lymphatic glands 122  
         of meninges 660  
         of mouth 425  
         of mucous membranes 124, 428  
         of nose 567  
         of pancreas 515  
         of serous membranes 355  
         of throat 446  
         of thyroid 623  
         of trachea 578

*(The numbers refer to the articles.)*

- tuberculosis, transmissibility of 125  
 tuberculous inflammation of vessels 296  
   inflammation of lymphatics 314  
   lymphadenitis 342  
   meningitis 660  
   myelitis 660  
   ulcer 391  
 tuberos tumor 137  
 tubules of kidney 520  
 tumor-cells in blood-vessels 264, 312  
   cells in lymphatics 316  
 tumors Sect. VI. (Part I.)  
   ætiology of 177 sqq  
   cachexia of 141  
   Cohnheim's theory of 177  
   congenital 178  
   definition of 136  
   growth of 139  
   malignancy of 140  
   metastasis of 140  
   of bronchi 583, 619  
   of heart 285  
   of intestine 478  
   of kidney 556  
   of larynx 575  
   of liver 502 sqq  
   of lung 619  
   of lymphatic glands 343  
   of mouth 438  
   of mucous membranes 431  
   of nose 568  
   of œsophagus 451  
   of pancreas 515  
   of salivary glands 448  
   of serous membranes 358  
   of spleen 329  
   of stomach 461  
   of trachea 578  
   of thymus 623 b  
   of thyroid 622  
   varieties of form in 137  
   vascular 312, 504  
 Türk, columns of 626  
 twins, homologous 12  
 tylomata 394  
 typhlitis 471  
 typhoid fever 474  
   fever, bacilli in 206  
   fever, brain in 637  
   fever, laryngitis in 572  
   fever, nephritis in 541  
   ulcer 474  
 tyrosin in acute atrophy of liver 489, 490  
   in blood 259  
 tyrosis 39  
 ulcer 102, 115, 116  
   cancerous 175  
   follicular 421, 470  
   rodent 402  
   tuberculous 121 sqq, 428, 475  
   typhoid 474  
   of the bronchi 582  
 ulcer of the duodenum 471  
   of the intestine 470  
   of the pharynx 450  
   of the skin 391  
   of the stomach 456, 459  
 ulcerative endocarditis 282  
   stomatitis 434  
 umbilical cord, withering of 41  
   hernia 465  
 umbilication in cancer 175  
   of pustules 388  
 uncinat gyrus 624  
 union of nerves 668  
 urachus 516  
 uræmia 259, 539  
 uratic concretions 560  
   concretions, structure of 531  
   infiltration of kidney 531  
 urea, excretion of 520  
 ureter, development of 516  
   malformations of 517  
 urethra, disorders of 564  
 urethral caruncle 564  
 uric acid in gout 259  
   acid in kidney 531  
 urinary organs Sect. IX. (Part II.)  
   fistula 563, 564  
 urine, foreign matters in 558, 559  
 urobilin 268  
 urobilinuria 68  
   after hæmorrhage 349  
 urogenital cloaca 516  
 urticæ 366  
 urticaria simplex 367  
   tuberosa 367  
 uterine fibroid 142, 153  
 vaccination 201  
   in anthrax 201  
 vaccinia 388  
   micrococci in 204  
 vagus-pneumonia 601  
 valgus (pes) 11  
 valves, deformity of 271  
 valvular aneurysm 282  
   thrombus 253  
   vegetations 280  
 varicella 388  
 varicocele 151, 306  
 varicose aneurysm 310  
   atrophy of liver 488  
   ulcer 306, 391  
   ulcer of œsophagus 450  
 variola 387  
   hæmorrhagica 361, 387  
   micrococci in 204  
   pustule of 372  
 varix 306  
   anastomotic 151  
   aneurysmal 301, 311  
   false 308  
   of brain 663  
   urethral 564  
 varus (pes) 11  
 vasa vasorum in organization 255

(The numbers refer to the articles.)

- vascularization of thrombi 255
- vascular mechanism, Sect. II. (Part II.)
  - neoplasms 312, 504
- vegetative endocarditis 280, 281
- vein-stones 254, 306
- venereal warts 394
- venom of serpents on blood 262
- venous engorgement of liver 483
  - engorgement of spleen 323
  - trunks, defects of 271
- ventral hernia 465
- vermiform appendage, inflammation of
  - 471
  - appendage, cyst of 471
- verrucae (see warts)
- vesical calculi 560
  - hæmorrhoids 561
- vesicles 366, 370, 371
- vesiculæ 368
- vesicular emphysema 593, 594
- vessels, air in 265, 266
  - changes in calibre of 301
  - degeneration of 287
  - dilated in inflammation 96
  - hypertrophy of 289
  - hypoplasia of 272, 286
  - inflammations of 290
  - rupture of 308
  - size of 286
  - wounds of 256
- vessel-walls in inflammation 97, 98
- vibices 361
- vibrio 186
  - serpens 185
- vibrio butyrique* 186
- villous tumor of bladder 562
- virus, attenuation of 201, 211
  - of tubercle 126, 127
- viscera, transposition of 11
- visual centres 625
- visual tract, atrophy of 640
- vitelligenous organ in tænia 241
- vittiligo 365
- vitreous degeneration 63
- volvulus of intestine 467
- vomica, bronchiectatic 583
  - phthisical 616
- warts, congenital 156, 179
- warts, hyperplastic 398
  - inflammatory 394
  - necrogenic 390
  - sebaceous 400
  - venereal 394
- warty endocarditis 280
- water canker 434
- waxy casts 533
  - degeneration 38
  - degeneration of heart 284
  - liver 57
- wens 399, 404
- wheals 366
- whip-worm 230
- white blood 260
  - hæmorrhage 260
  - kidney 536, 537
  - pneumonia 607
  - softening 642
- whitlow 390
- Wirsung, canal of 513
- witches'-brooms 220
- wolffian bodies 516
  - ducts 516
- wood-tick 225
- woolsorters' disease 206
- worms 227 sqq
- wound infection 204
- wounds, healing of 107
  - of blood-vessels 256
  - of brain 658
- xanthelasma 401
- xanthine calculi 532, 560
- xanthoma 401
- xeroderma 364
- xiphopagi 12
- yeast-fungi 223, 224
  - in urine 559
- yellow atrophy of liver 489, 490
  - softening of brain 642
  - softening of thrombi 254
- zona 371, 383
- zoogloea 184
- zoster, herpes 371, 383
- zygospore 213, 215











Cornell University Library  
**RB 111.Z66 1882**

v.3

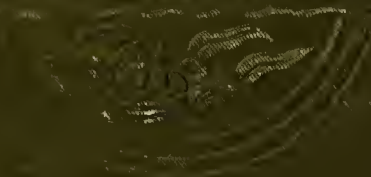
**A text-book of general pathological anat**



3 1924 012 153 841

al

WOOD'S LIBRARY



AND ILLUSTRATED BY



WILLIAM WOOD & COMPANY NEW YORK